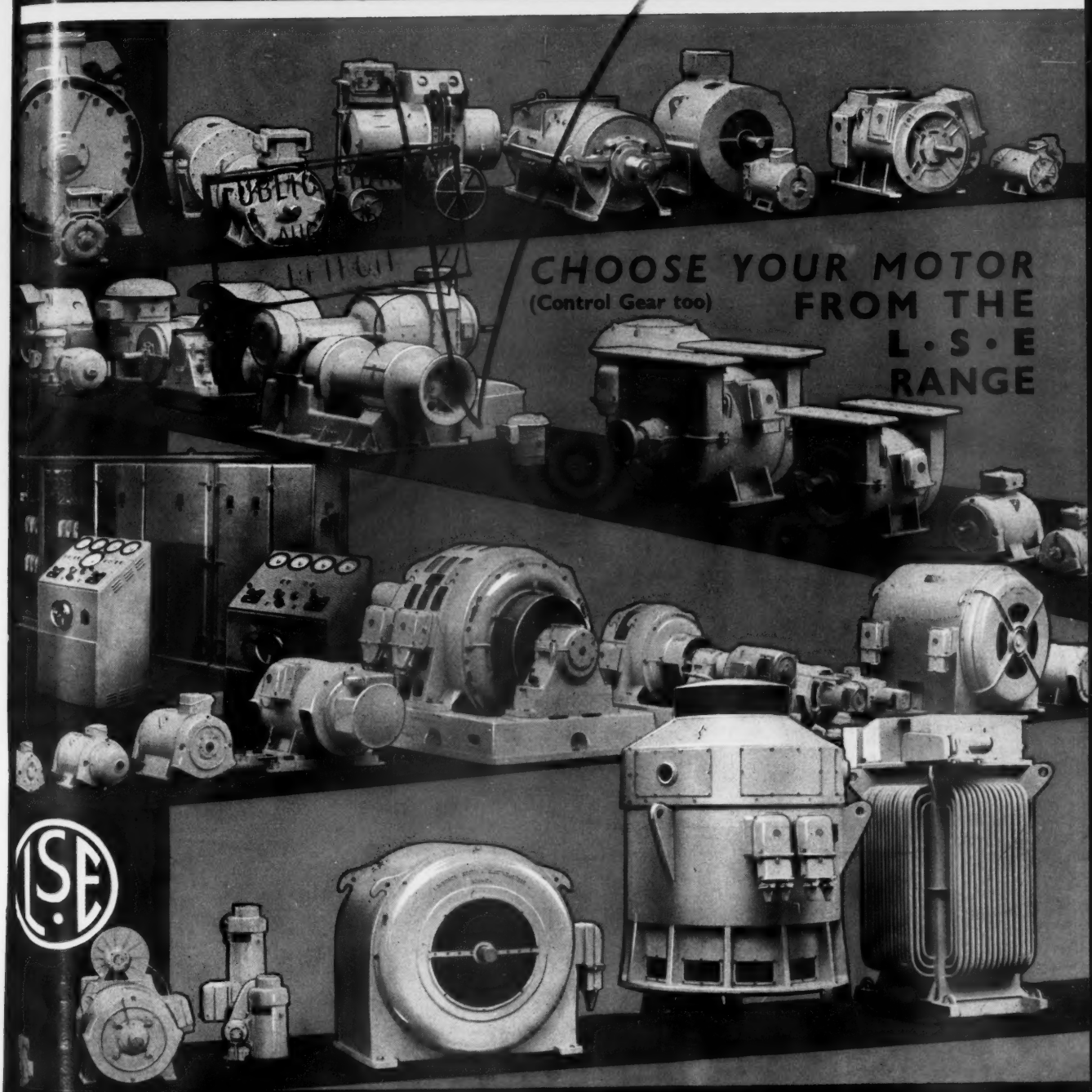
LOGY DEPT.

ELECTRICAL REVIEW

4 JULY 1954

MEETING



AURENCE, SCOTT & ELECTROMOTORS LTD.
cialist Makers of Electric Motors since 1883
NORWICH MANCHESTER & BRANCHES

We have extensive experience in the machining of our own electrical insulating materials. The group shows some of our work on Paxolin Laminated, Panilax Laminated, and Grey Vulcanised Fibre

m and i

THE MICANITE & INSULATORS CO. LTD

EMPIRE WORKS · BLACKHORSE LANE · WALTHAMSTOW · LONDON · E.17

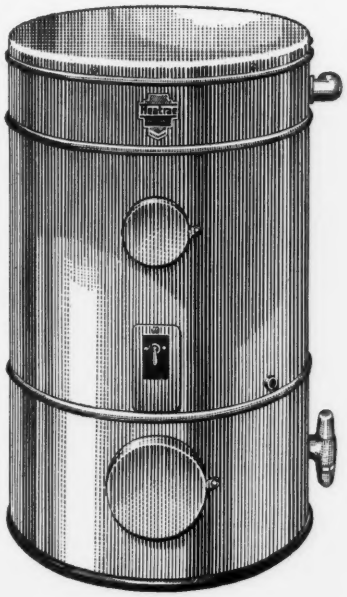
BRANCH OFFICES at BIRMINGHAM · CARDIFF · GLASGOW · MANCHESTER and NEWCASTLE-UPON-TYNE and representatives in most countries throughout the world. In CANADA, MICANITE CANADA, LTD.

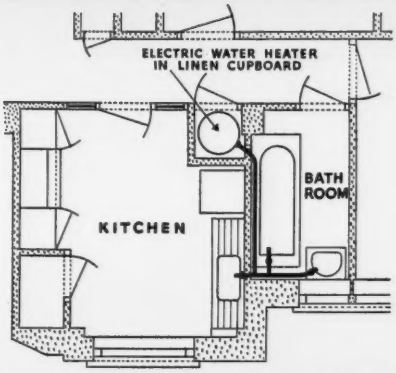
Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. PANILAX Laminated Materials and Mouldings. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS & TERMINALS. Distributors of Micoflex-Duratube Sleevings, Micoflex-Durasleeve (Plastics-covered flexible metal conduit) and Kenutuf Injection Mouldings (in most thermoplastics including P.V.C.)

Simplicity—The Hallmark of Genius . . .

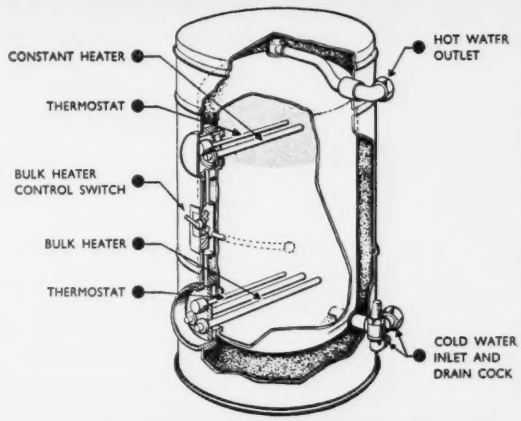
Heatrae

electric water heaters





are so simple . . .



The Heatrae Two-Twenty. Nominal water capacity: 20 gallons.

Two banks of removable core heating units, each controlled separately by a thermostat.

All units are interchangeable.

Cable entry and control switch well above floor level.

Heatrae Two-Twenty fits easily under the draining-board; or an ideal position for it is in a small cupboard adjacent to the kitchen and bathroom—as shown. The upper part of the cupboard can then be used as an airing chamber so that the very small heat losses from the heater are put to useful account.

There is also a Heatrae One-Twenty—similar to the Two-Twenty except that it has one heat zone only at the bottom, automatically controlled.

The hand switch is unnecessary.

Full details on request.

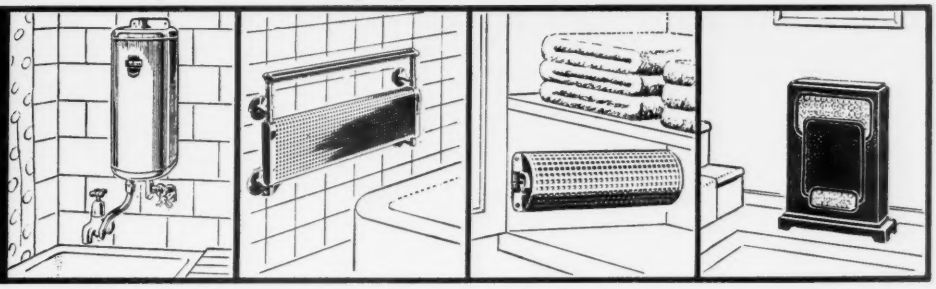
so simple to **install**

so simple to **service**

Heatrae

30 years specialised experience in designing and manufacturing of Electric Water Heaters

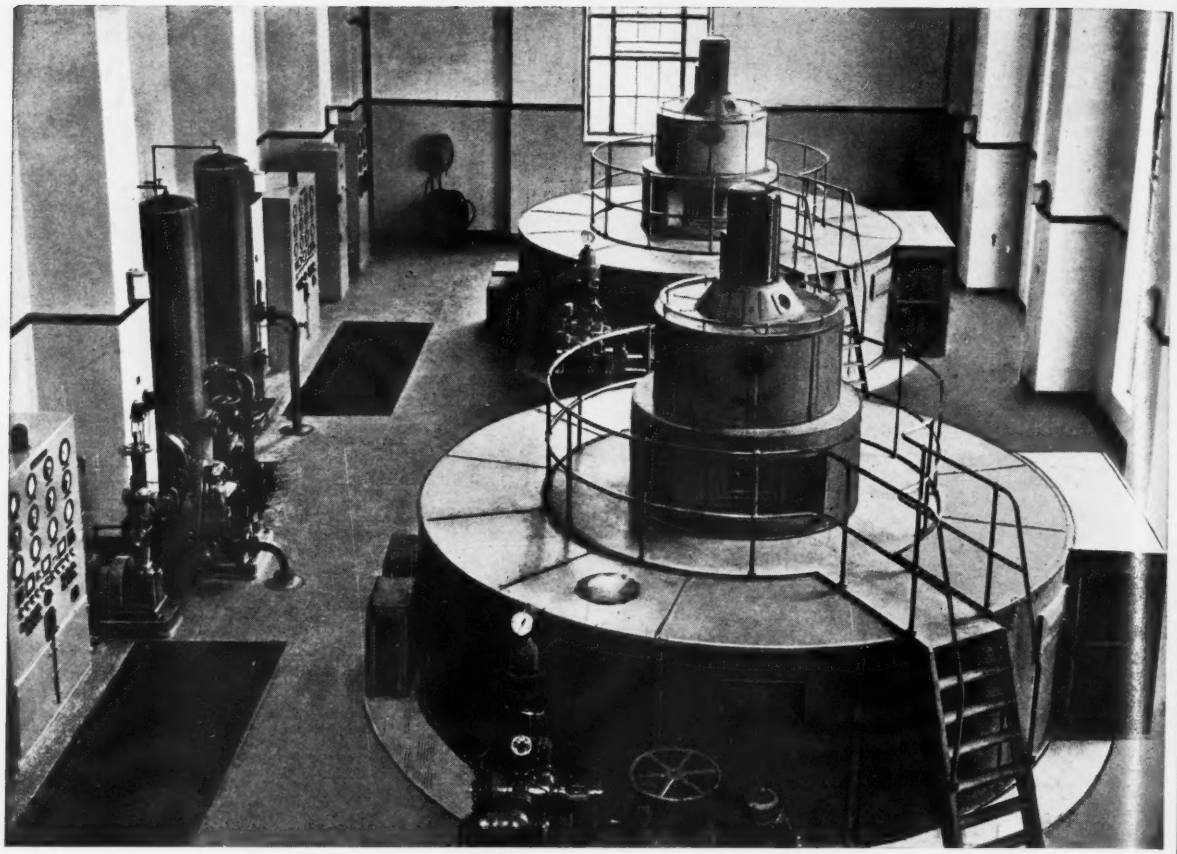
Here are some of the extensive range of our products for industrial and domestic uses . . .



• D.O.T. ELECTRIC WATER HEATER • AIR WARMER/TOWEL RAIL • AIRING CUPBOARD HEATER • ELECTRIC AIR CONVECTOR

Advertisement issued by HEATRAE LTD · NORWICH · ENGLAND

Manufacturers of: Electric Water Heaters, Oil Heaters, Immersion Heaters, Urns, Towel Rails, Airing Cupboard Heaters, Flameproof Heating Apparatus, Breakfast Cookers, Electric Fires, Food Trolleys, Warming Plates, Air Heaters.

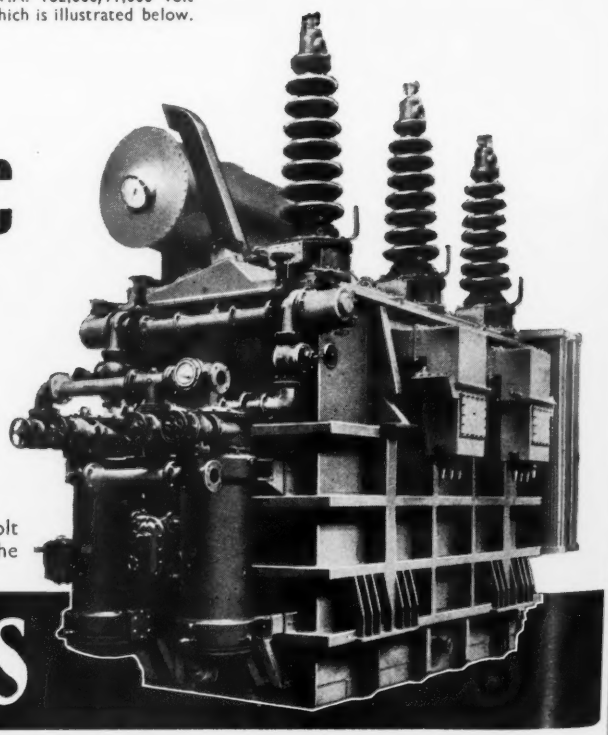


LOCH FANNICH PROJECT, North of Scotland Hydro-Electric Board. View of Grudie Bridge power station showing two 12,000 K.W. 11,000 volt, 500 r.p.m. vertical generators. The installation includes two 20,000 K.V.A. 132,000/11,000 volt water-cooled transformers, one of which is illustrated below.

PEEBLES

hydro-electric plant

Bruce Peebles build large and small generators for all types of water turbines, and transformers up to the largest sizes for hydro-electric power distribution.

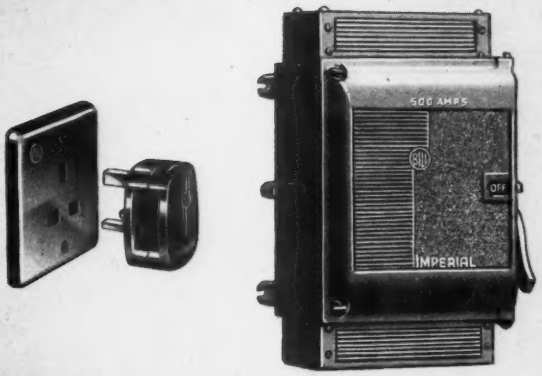


20,000 kVA. 132,000/11,000 volt water-cooled transformer for the Loch Fannich scheme.

BRUCE PEEBLES

Advertisement of BRUCE PEEBLES & CO. LTD. • ENGINEERS • EDINBURGH • SCOTLAND 3974

You cannot buy better gear



BILL COMPLETE RANGE
13 AMP SOCKET OUTLET TO 500 AMP FUSE SWITCH

★ SOCKET OUTLETS
★ COOKER SWITCHES
★ DISTRIBUTION BOARDS
★ SWITCHES AND SWITCH FUSES
★ INDUSTRIAL PANELS

BILL SWITCHGEAR LTD.
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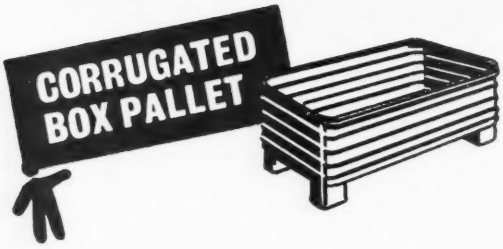
GATESHEAD 8. S. J. DAVIS. 232 PRINCE CONSORT RD.
GLASGOW. J. D. HARRIS. ST VINCENT LANE

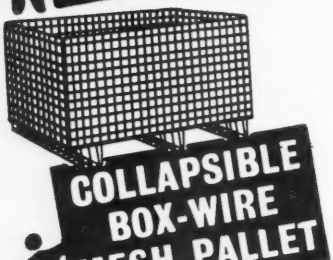


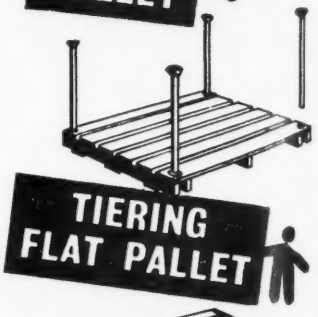
FISHOLOW

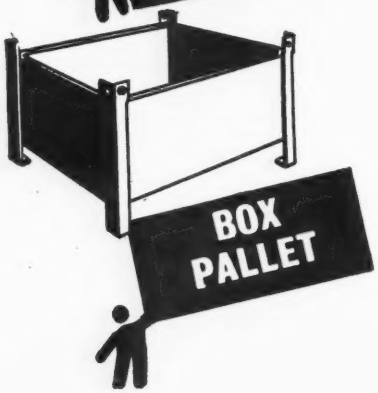
FLOWSTACK PALLETS

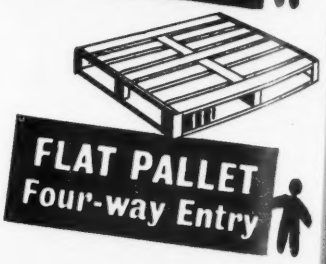
SERVANTS OF INDUSTRY

Palletisation—a word of one meaning and innumerable applications—the answer to a great many problems concerned with the handling of materials. Ten basic pallet types are illustrated here, and each can be modified to meet individual requirements of size and capacity. Materials suitable for palletisation fall into eight main groups and may be large or small, loose or bagged, or hot from production processes. There is a FLOWSTACK Pallet designed to meet every condition. The FLOWSTACK PALLET MANUAL describes the entire range of pallets in full detail, and includes a unique Pallet Selection chart. Material Handling Engineers and Company Executives are invited to write for a copy on their business letter heading.



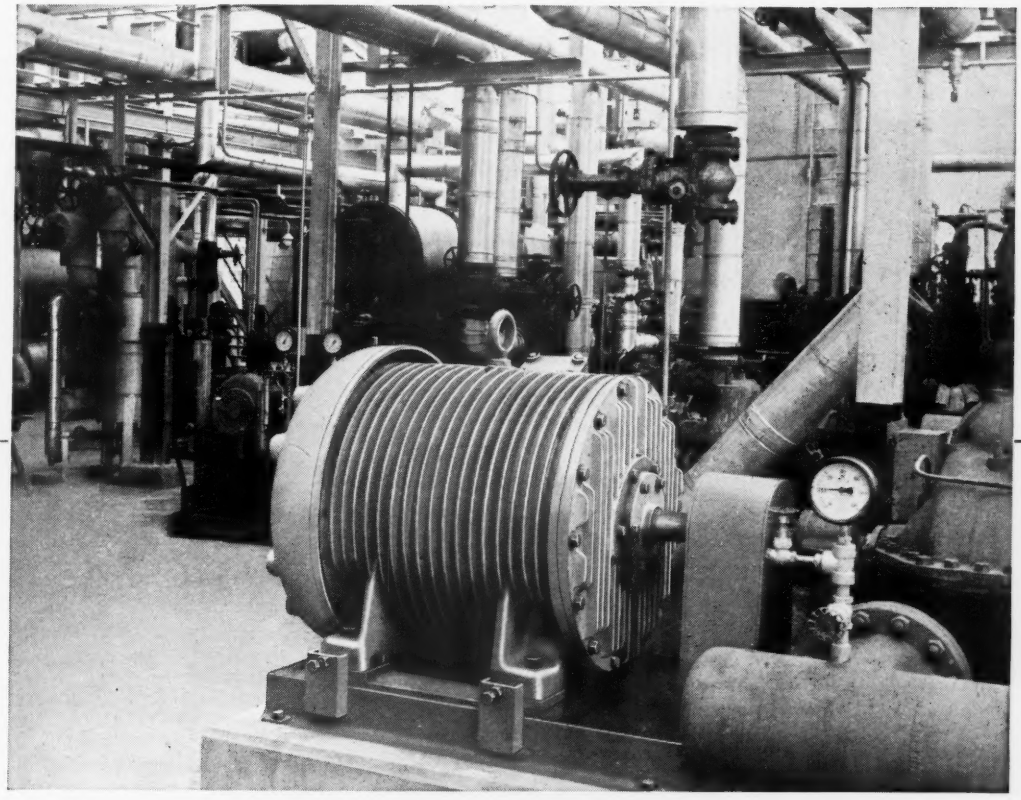






FISHER & LUDLOW LTD *MATERIAL HANDLING DIVISION*
BORDESLEY WORKS, BIRMINGHAM, 12 *Tel: VIC 2371*
Also at London, Manchester, Liverpool Cardiff, Glasgow, Newcastle-on-Tyne, Belfast and Dublin

Flame-proof motors at Coryton Refinery



The ENGLISH ELECTRIC Company has supplied a considerable number of totally-enclosed, fan-cooled, flame-proof, squirrel-cage motors for use in The Vacuum Oil Company's Refinery at Coryton, Essex. These motors, which were delivered through The Lummus Company, have outputs ranging from 75 to 150 h.p., and the majority are used to drive pumps.

'ENGLISH ELECTRIC'

flame-proof motors

See also our Fusegear advertisement in this issue

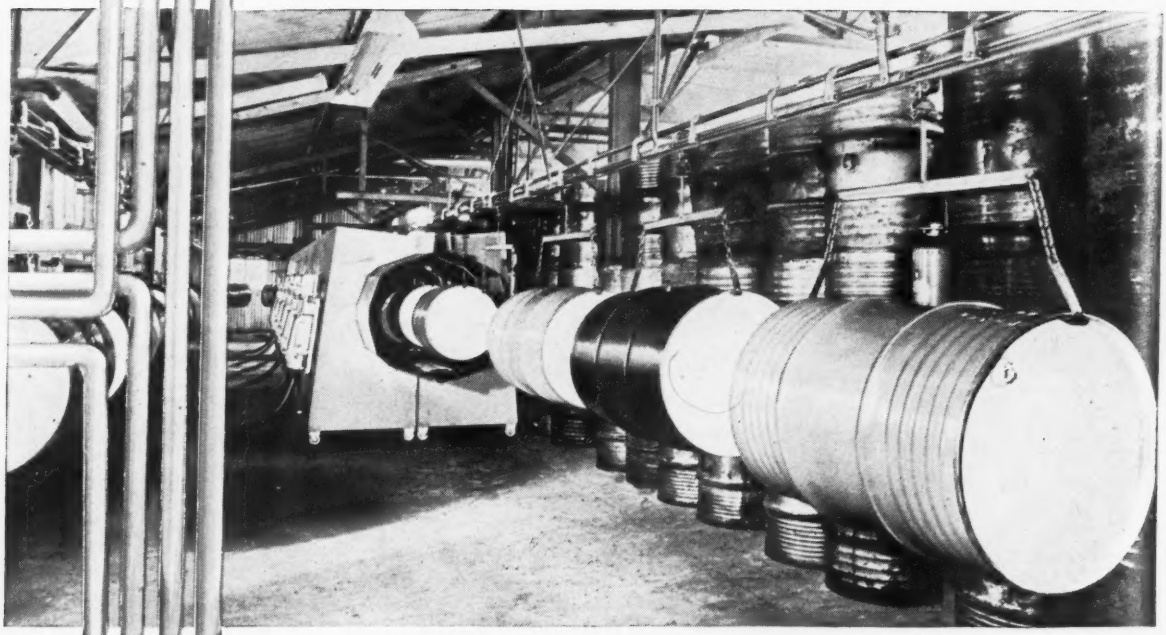
THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Industrial Motor Works, Bradford

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

BM. 29E4

Paint stoving 40 gallon steel drums at 180 per hour with...



G.E.C.

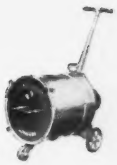
INFRA-RED HEATING

G.E.C. Infra-Red plant is used for stoving paint on a variety of products—from beer bottle caps to ships' hull plates. Write for particulars.

THE GENERAL ELECTRIC CO., LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Sturtevant

Industrial Vacuum Cleaners

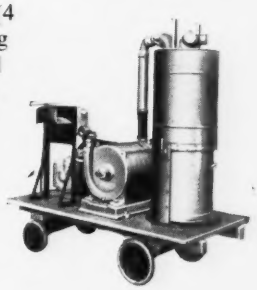


4

THE Sturtevant No. 4 (2 stage) Portable Vacuum Cleaner/Blower, although of medium size is essentially a heavy duty type—ideal for routine cleaning in factories of average size where the work is of a fairly light nature. A wide range of tools allows for the cleaning of floors, walls, pipes, machinery, etc.

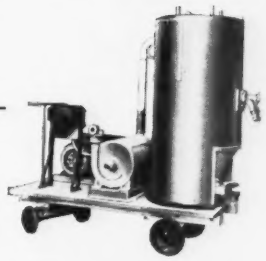
5

FOR operating on a wider scale this Sturtevant No. 5 (4 stage) Portable Vacuum Cleaner/Blower is recommended, having that extra power which has made it so popular for industrial work of not too arduous a character. Large air volume, high suction and outstanding performance for its size are features resulting from sound construction of quality materials.



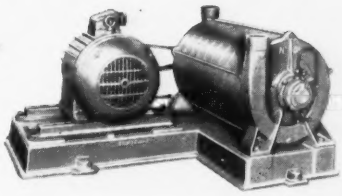
6x

FOR full scale cleaning in large lofty factories with considerable floor area the Sturtevant No. 6x Portable Truck Mounted Vacuum Cleaner with dust bin type filter is available in varying capacities and designed to accommodate two operators working simultaneously on certain duties.



6x

THIS Sturtevant No. 6x machine is equipped with a capacious filter-receiver to handle and accommodate bulk quantities of dust and waste—also to recover valuable spillage. It is ideal for coping with conditions found in the heavy industries. There are four sizes, with accommodation for two or three operators.

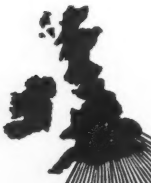


10x

STURTEVANT Turbo Blowers/Exhausters are available in a wide range handling air from 50 to 3,000 c.f.m., for pressure and vacuum applications such as pneumatic conveying; aeration and agitation of fluids; vacuum cleaning plants; duties where clean, dry, uniform air flow is essential.

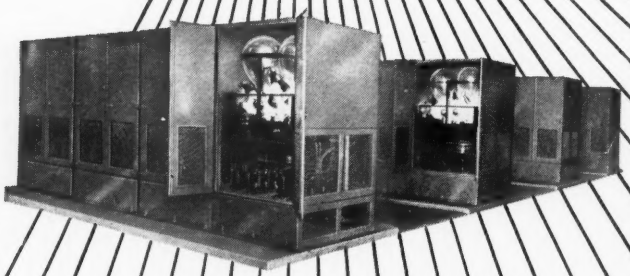
Details of any of the above machines will gladly be supplied from our department U.101/26.

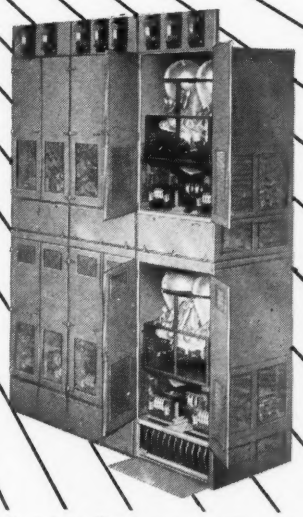
STURTEVANT ENGINEERING CO. LTD., SOUTHERN HOUSE, CANNON ST., LONDON, E.C.4

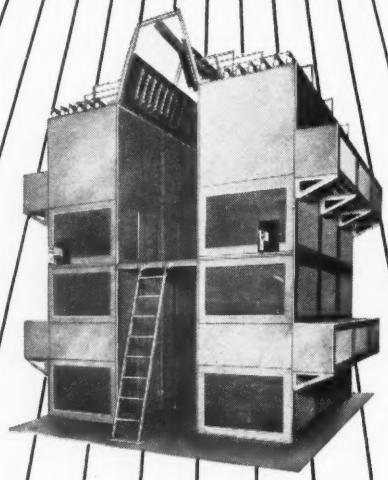


Made in Britain for service throughout the World...

Hewittic Rectifiers in traction service in Canada (British Columbia Electric Co.). Each bank has a capacity of 1,500 kW. with high overload rating for heavy traction service. The total capacity of Hewittic Rectifiers on this system is approximately 30,000 kW.







Hewittic 1800 kW. rectifier. One of a number, totalling 15,000 kW., supplying the D.F. Sarmiento Argentine National Railway.

Hewittic rectifiers in service in India. One of a large number of equipments totalling over 70,000 kW. for D.C. light and power — output 1700 kW. three wire under tropical conditions.

HEWITTIC rectifiers

over 1¼ Million kW. in World-wide service

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone : Walton-on-Thames 760 (8 lines) *Telegrams : "Electric, Walton-on-Thames"*

Hot water by electricity?

SADIA

of course!

The Range of Electric Water Heaters, large and small, to meet every need. Each unit is built to a proud standard of perfection arrived at by more than 30 years of specialisation in electric water heating problems.

Please write for fullest details to :—

AIDAS ELECTRIC LTD., SADIA WORKS, ROWDELL RD., NORTHOLT, GREENFORD, MIDDX.

Phone : WAXLOW 1607

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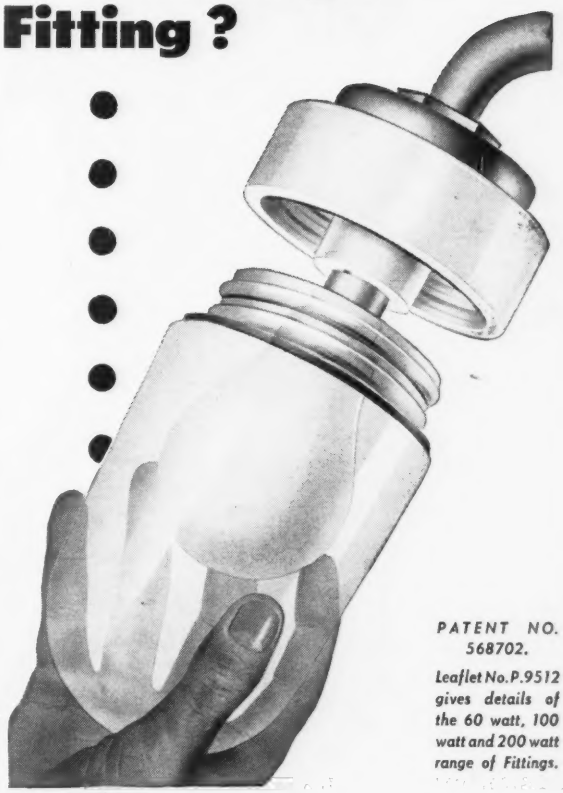
Manufactured in S. Africa by :— Sadia Water Heaters (Pty) Ltd., 3 - 5 Newton Street, Village Main, Johannesburg.

What is the R.E.A.L. cost of re-lamping a Watertight Fitting ?



PATENT NO. 568702.

Leaflet No. P.9512 gives details of the 60 watt, 100 watt and 200 watt range of Fittings.

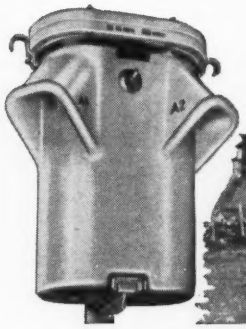
Because THERE NEVER CAN BE ANY CORROSION WITH A R.E.A.L. FITTING you can remove and replace the screw-neck well glass in a matter of seconds . . . not so costly . . . is it ?

Issued by Rowlands Electrical Accessories Ltd., R.E.A.L. Works, BIRMINGHAM 18

British Power Transformers

for rural distribution

in hermetically-sealed stoneware containers



Photograph by courtesy of British Insulated Callender's Construction Co. Ltd. and the North of Scotland Hydro-Electric Board.

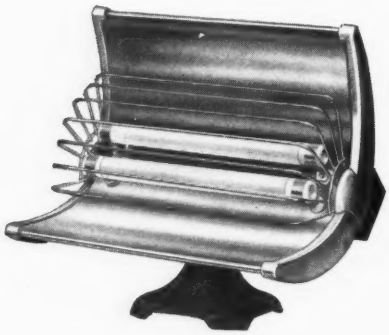
- No maintenance costs. Containers are salt and acid proof. Supporting steel work is heavily galvanised. Hermetically sealed container protects oil from acidity.
- Increased efficiency and reduced operating costs due to low losses.
- High Overload Capacity.
- Simple installation—only one or two bolts required. Other types of distribution transformers, including units to the Draft National Standard Specification T.1. in steel tanks, can also be supplied.

BRITISH POWER

BRITISH POWER TRANSFORMER CO. LTD.

Telephone: HOWard 1492 QUEENSWAY, PONDERS END, MIDDLESEX *Telegrams: Vitrohm Enfield*

BP/3112/AH



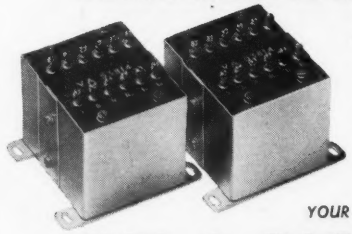
THE 'ARORA' REFLECTOR FIRE
WITH THE **LONG-LIFE** ELEMENT

THE POPULAR **FOUR-TEN** MODEL
IS NOW AVAILABLE IN 1-BAR
& 2-BAR SIZES

Send for full details to :—

THE ARORA COMPANY
ROSEBERY ST., LOUGHBOROUGH, LEICS.
Telephone 2603

TRANSDUCTORS



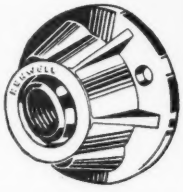
AS MANUFACTURED FOR
THE ENGLISH ELECTRIC CO. LTD.
A.I.D. and A.R.B. APPROVED

YOUR ENQUIRIES ARE INVITED

AVIS & BAGGS LTD.
GOSBROOK ROAD, CAVERSHAM
READING *Phone: READING 71763*

ask your wholesaler for
KENWELL
COMPONENTS

The Kenwell Angle Ball Socket for every North Light roof job.



The Kenwell Standard Ball Socket is at the roots of every good lighting installation.

The Kenwell Antivibrator which puts life into lamps.

KENWELL ELECTRIC LTD.
Lanehead Works, Bacup, Lancs. *Phone 473*

FIRST.... 100,000 kVA BANK

for **GARRISON DAM PROJECT**
NORTH DAKOTA U.S.A

230 kV, 33,333 Ferranti Transformers

The first three Ferranti single-phase 13.2/230 kV, 33,333 kVA generator transformers for the U.S. Army Corps of Engineers for the Garrison Dam Project, North Dakota, U.S.A. have now been shipped. The contract is for nine 230 kV transformers which will form three 3-phase 100,000 kVA banks.

This modern factory covering approximately 186,000 square feet, has a manufacturing capacity of over 5 million kVA of Large Power Transformers per annum.

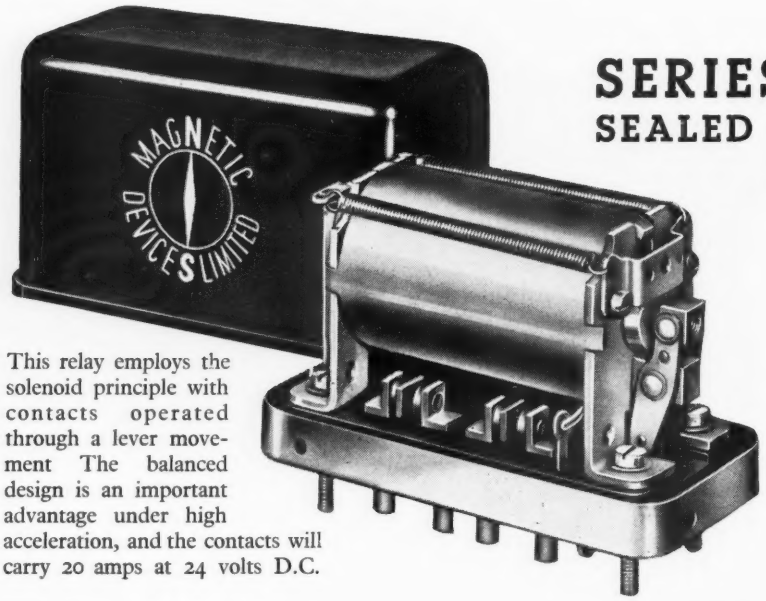
FERRANTI

FERRANTI LTD. *Head Office & Works:* **HOLLINWOOD · LANCASHIRE**
LONDON OFFICE: KERN HOUSE, 36 KINGSWAY, W.C.2

FERRANTI

FT.140

RELAYS



SERIES 1265
SEALED **D.C. OPERATED**
Standard coil voltages up to 50 volts D.C.

This relay employs the solenoid principle with contacts operated through a lever movement The balanced design is an important advantage under high acceleration, and the contacts will carry 20 amps at 24 volts D.C.

Two small types for **BIG** loads

Both the relays illustrated combine strength with high current carrying capacity, and are designed to ensure long, trouble free life. Made from highest quality materials throughout, they may be the answer to your switching problem, especially if space is restricted.

SERIES 151
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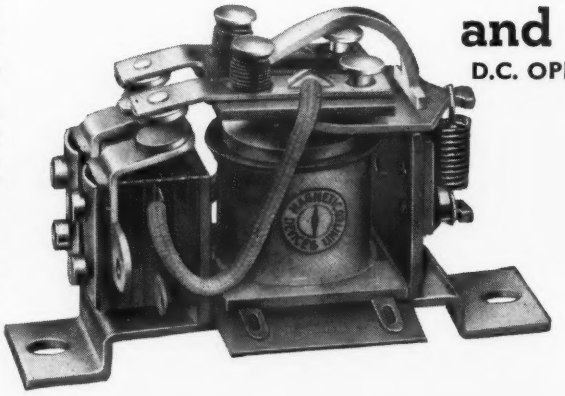
An exceptionally small relay in proportion to the contact rating of 15 Amperes, a feature is the heavy overload it is capable of withstanding for short periods, rendering it particularly suitable for such applications as starting low voltage D.C. motors. Coils are available in all standard voltages up to 250v. A.C. and 140v. D.C.



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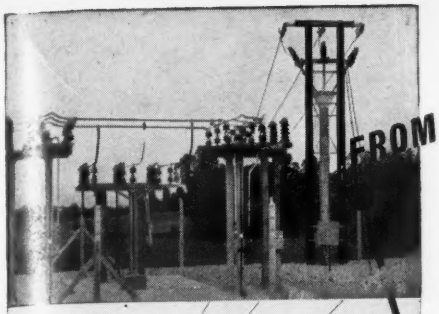

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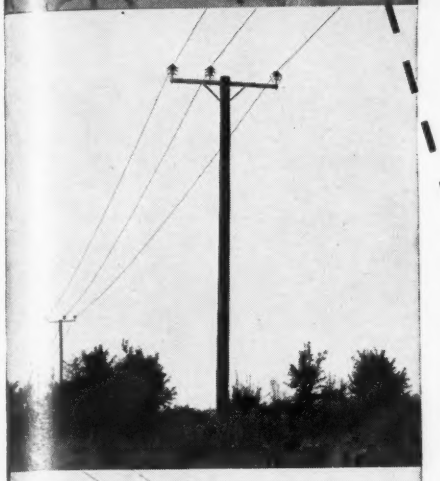

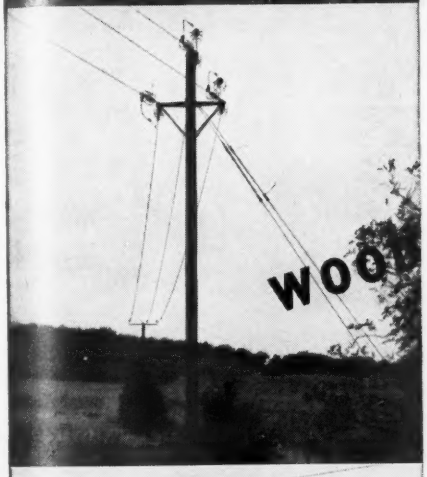

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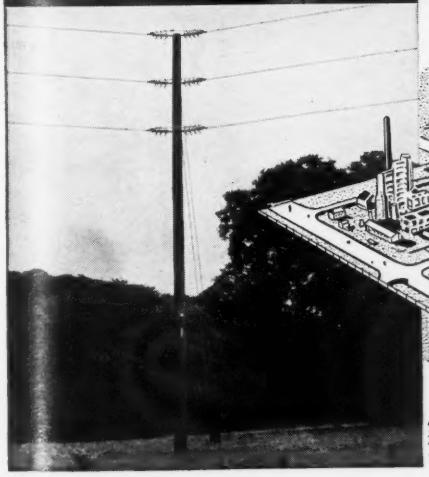

This 33kV single-circuit, wood pole overhead line was erected by HENLEY Contract Engineers for the South Eastern Electricity Board to supply the Anglo-Iranian Isle of Grain Refinery, Kent. The line, 13½ miles long, is fed from a substation on Watling Street, Shorne.

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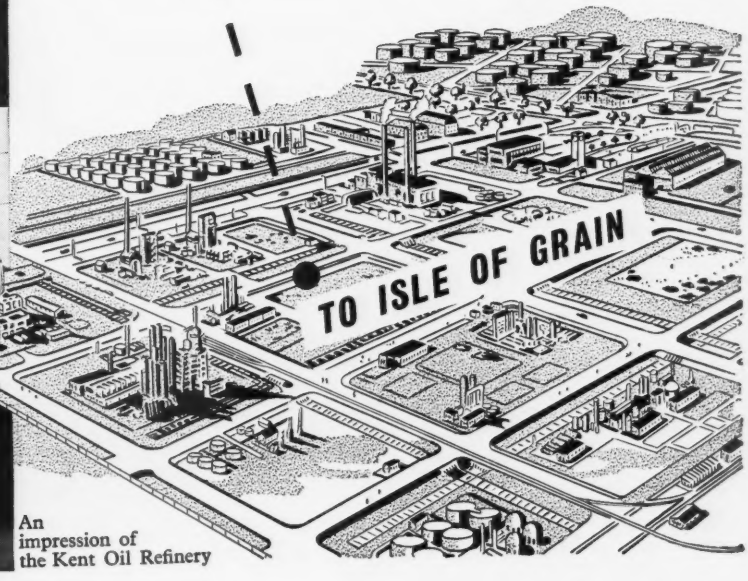

An impression of the Kent Oil Refinery

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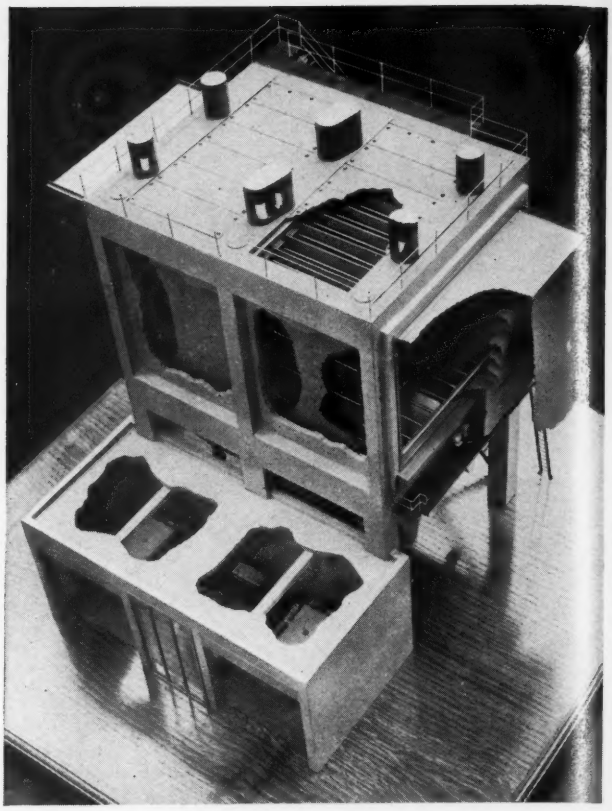
Shown here are views of a model of a typical Simon-Carves electro-precipitator as installed on a modern power station.



View of flue-dust electro-precipitator model.

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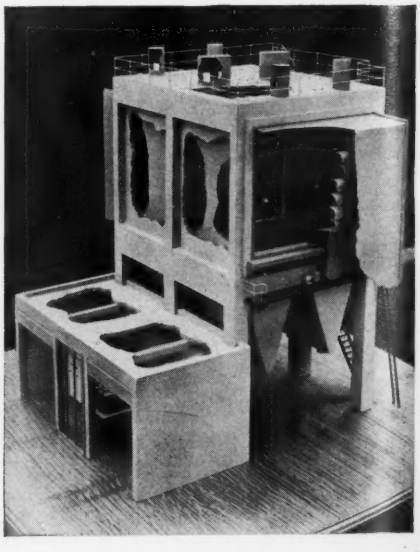

The arrangement of the electrodes is shown in this view of the model.

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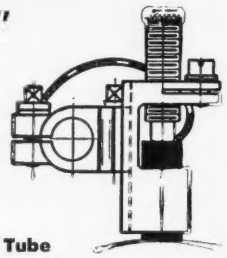

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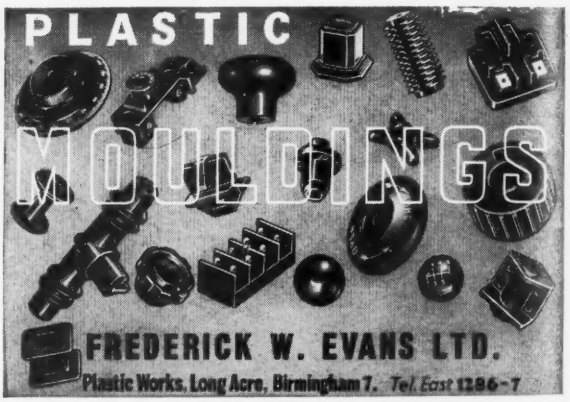

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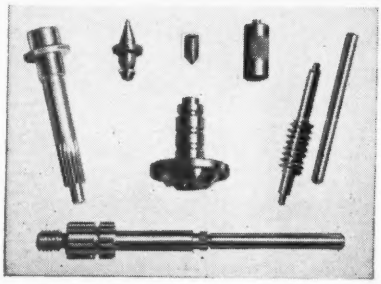

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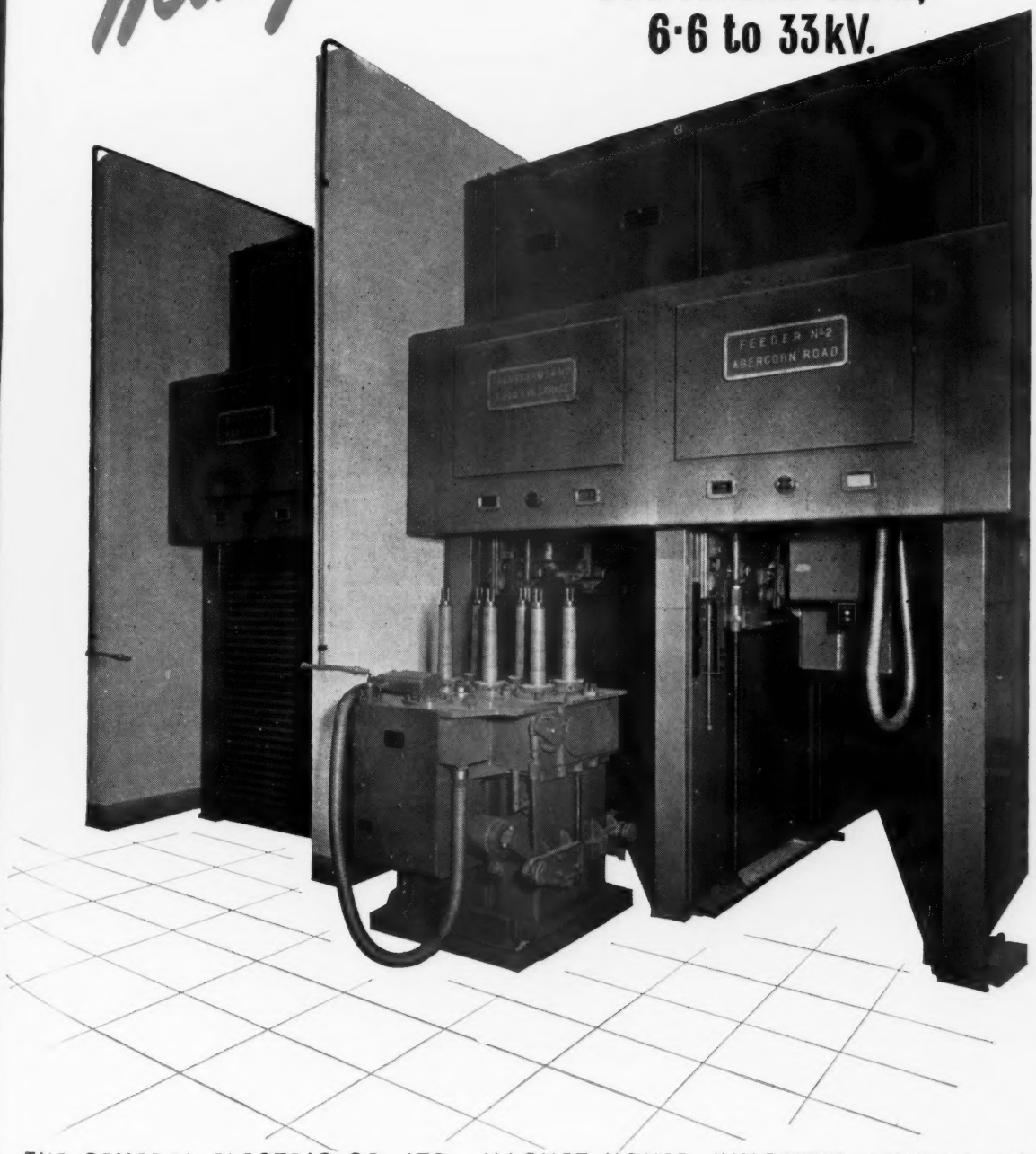

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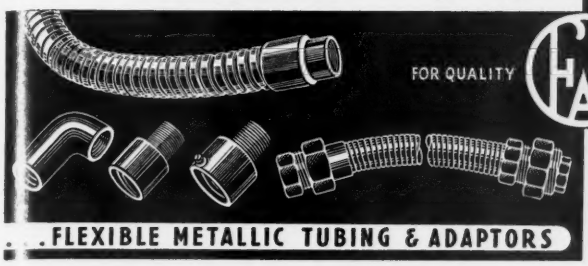

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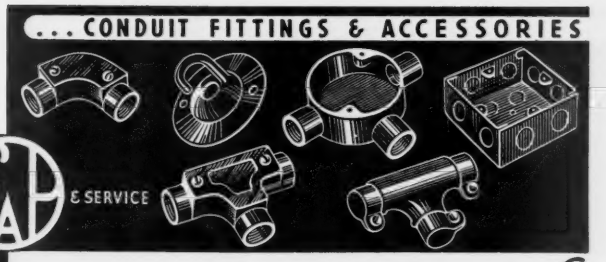

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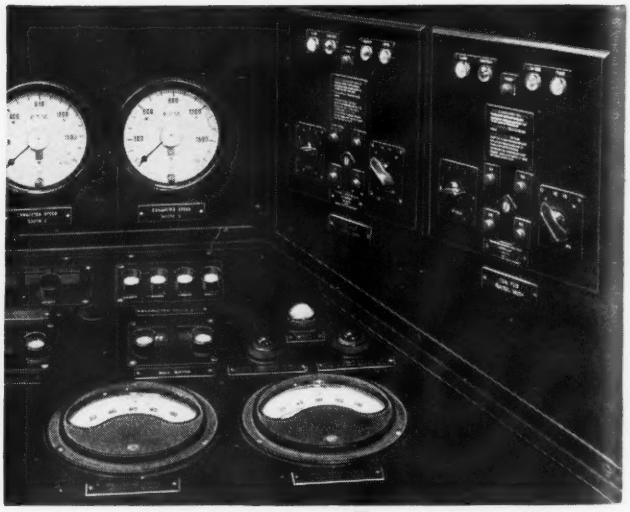

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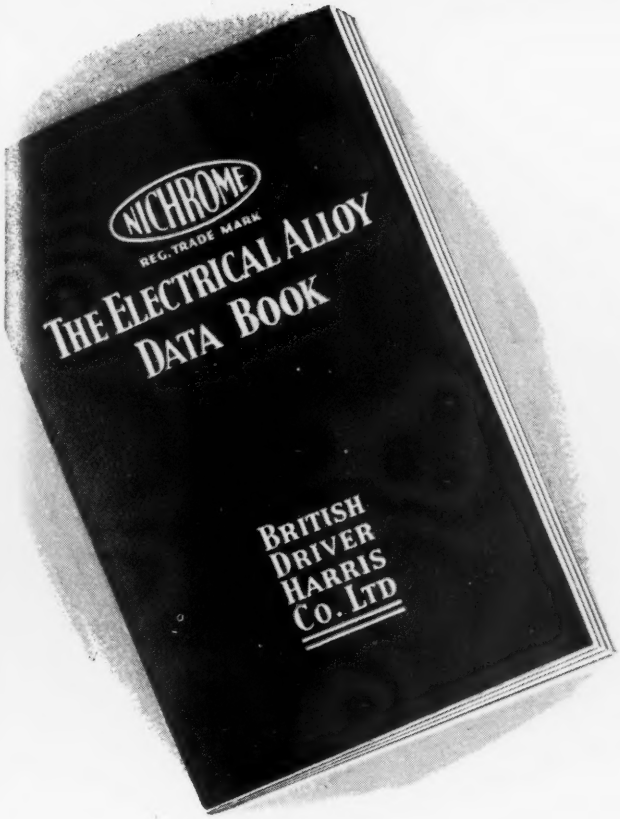

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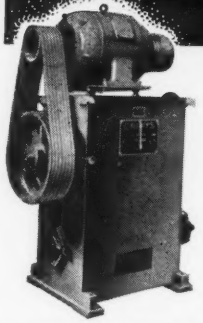

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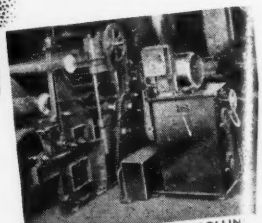

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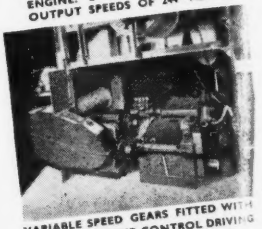

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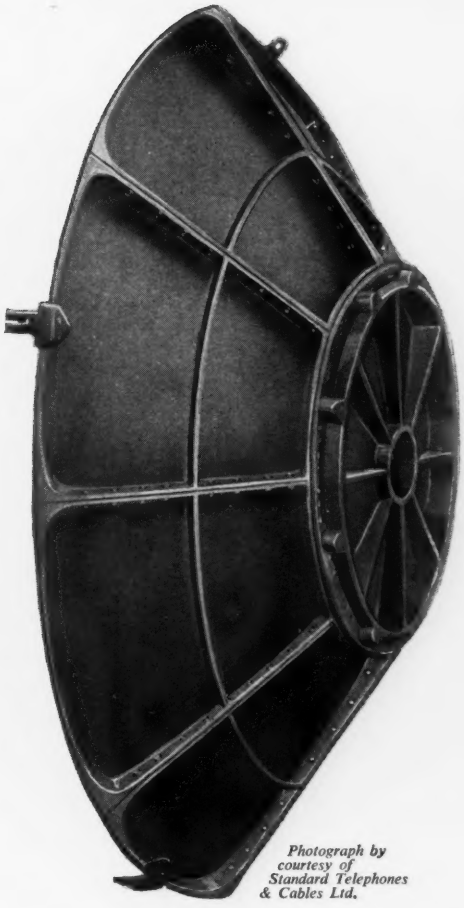

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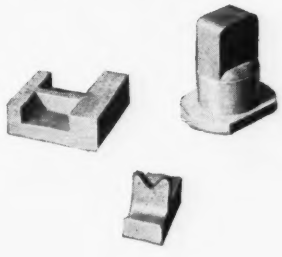

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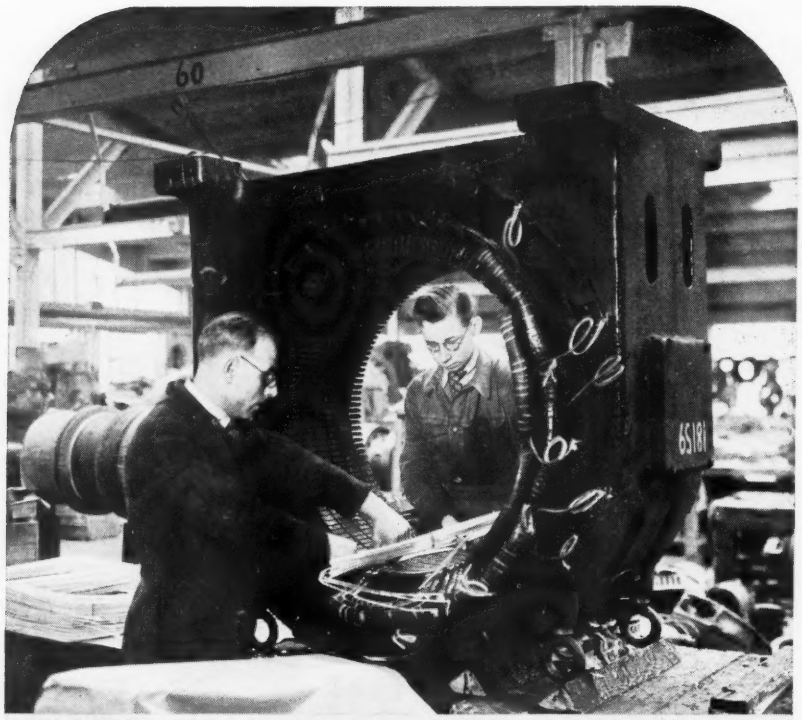

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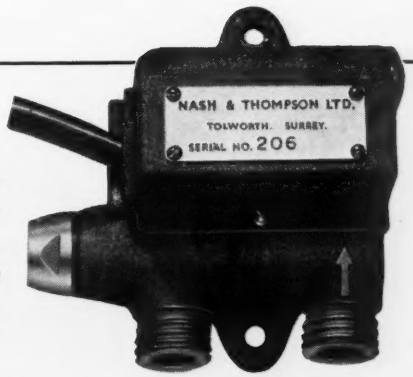

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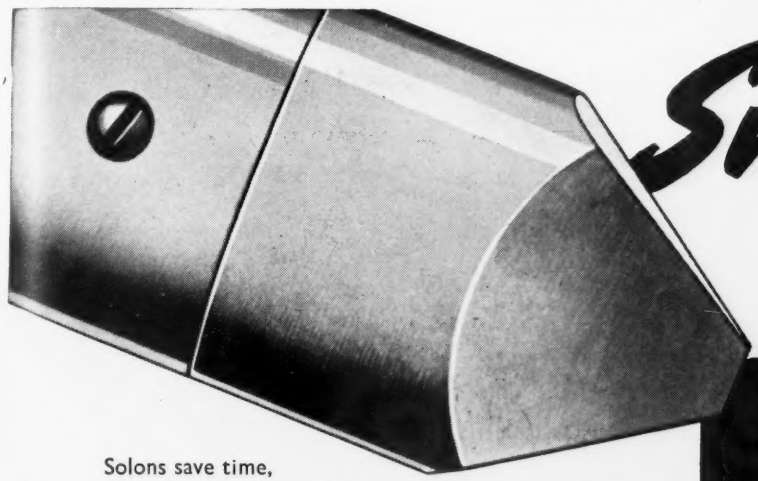

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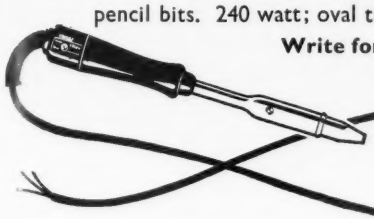

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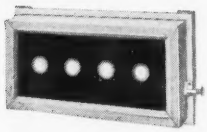

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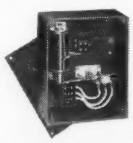

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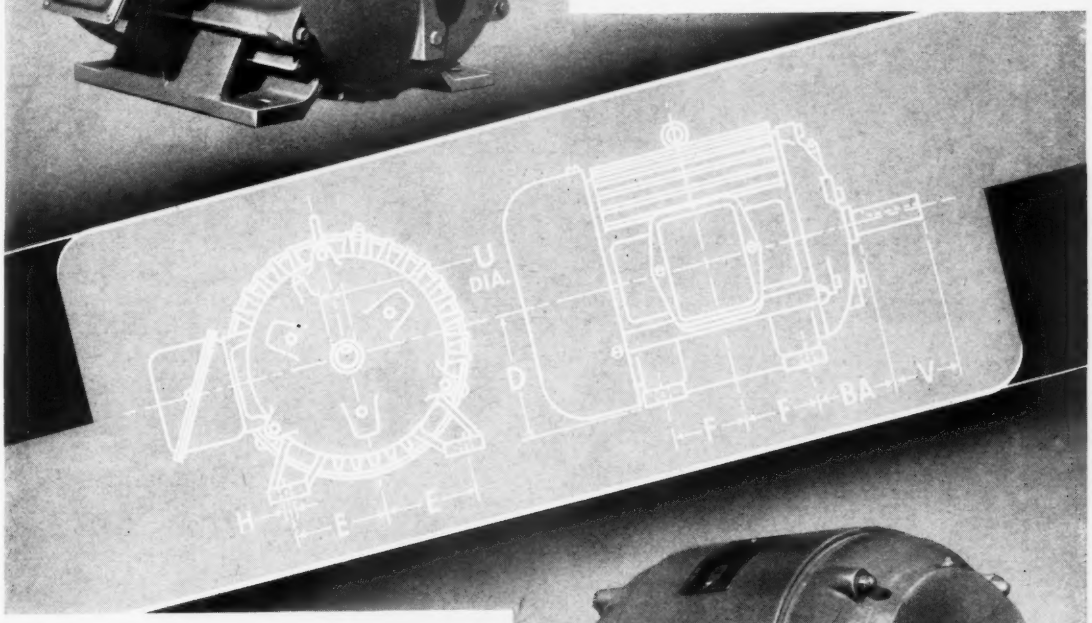

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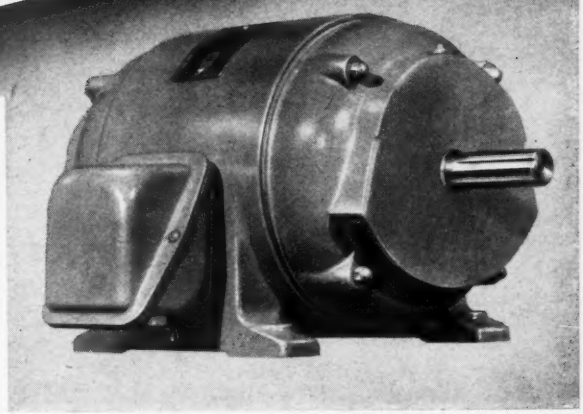
Made to conform with British Standard 2083 : 1954 for output and dimensions giving interchangeability with the Totally Enclosed types at more economic cost.



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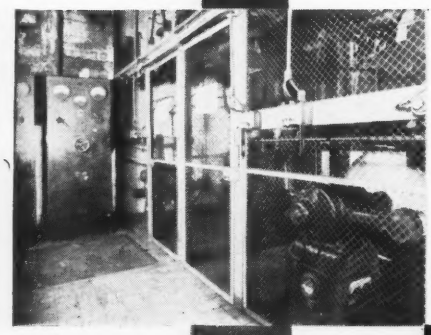

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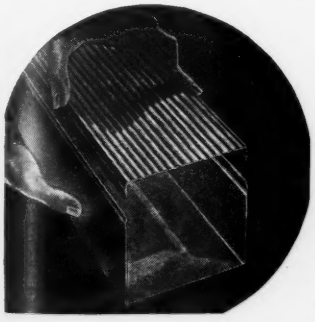

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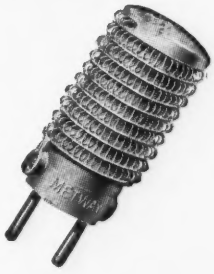

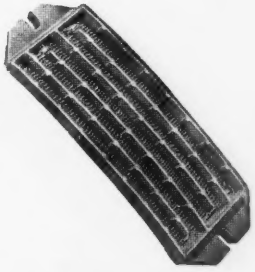

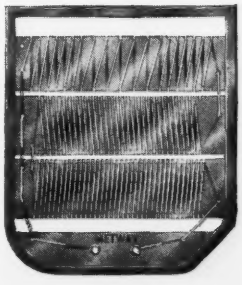

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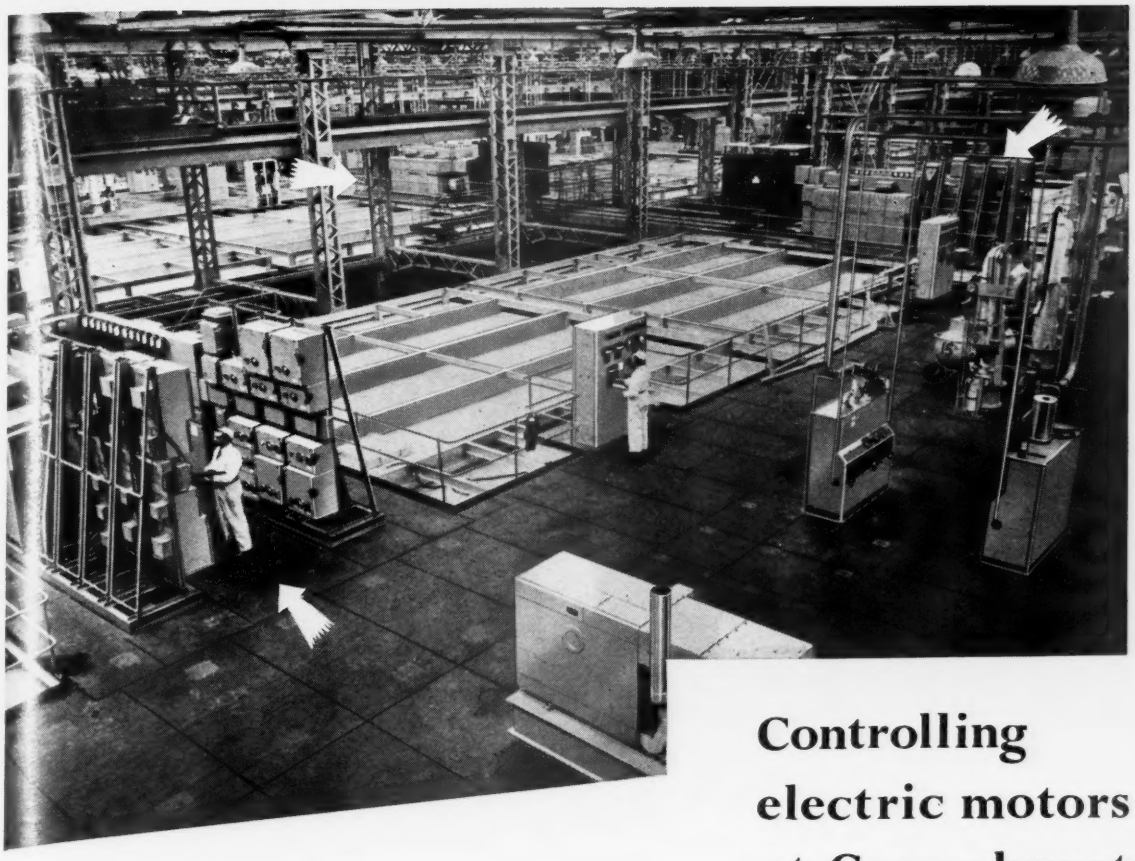

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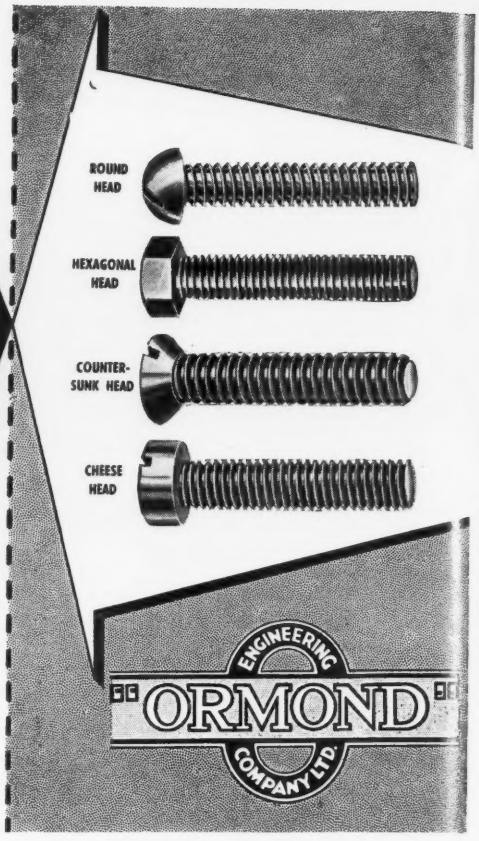

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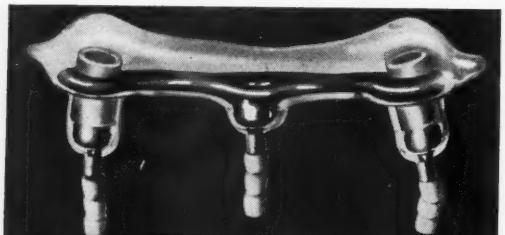

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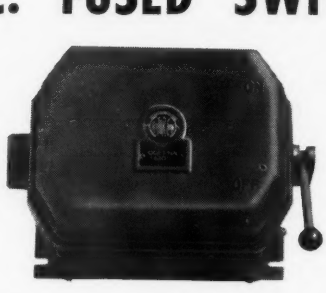

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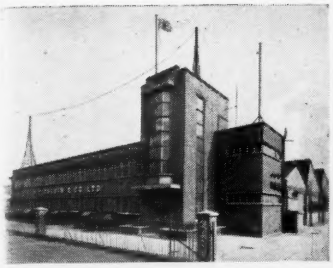

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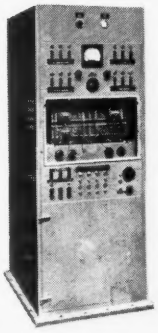

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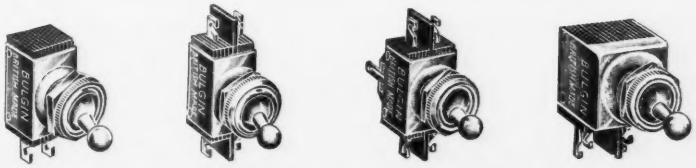

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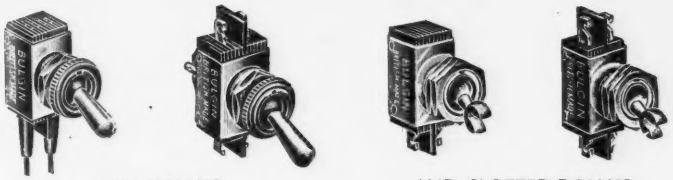

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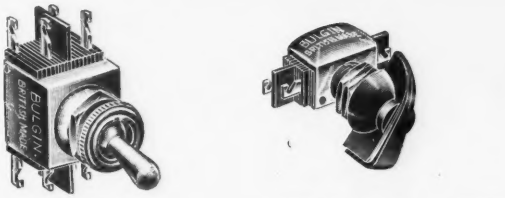

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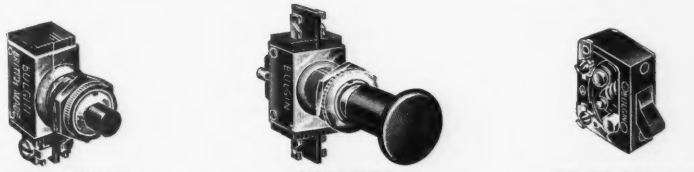

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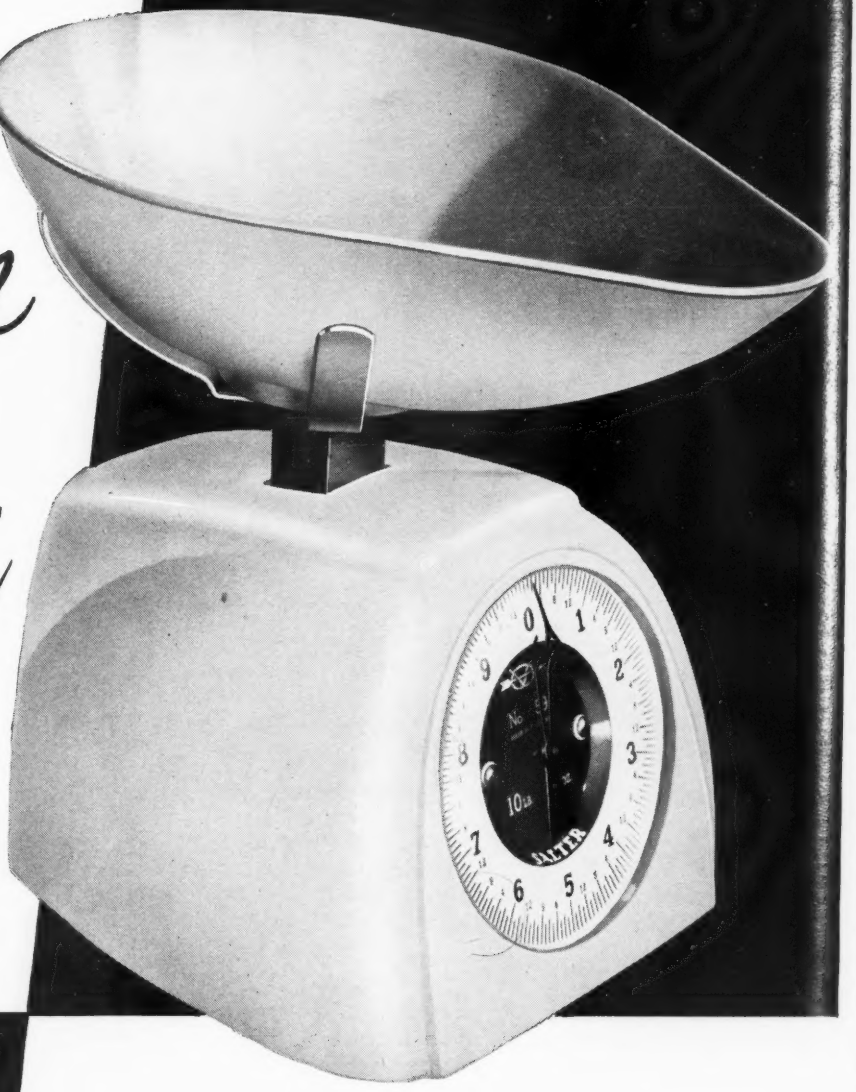

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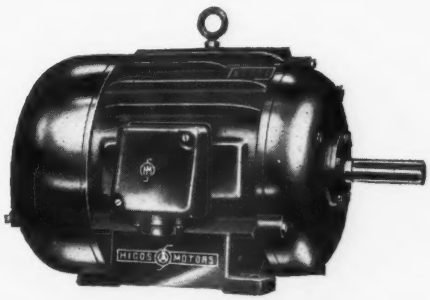

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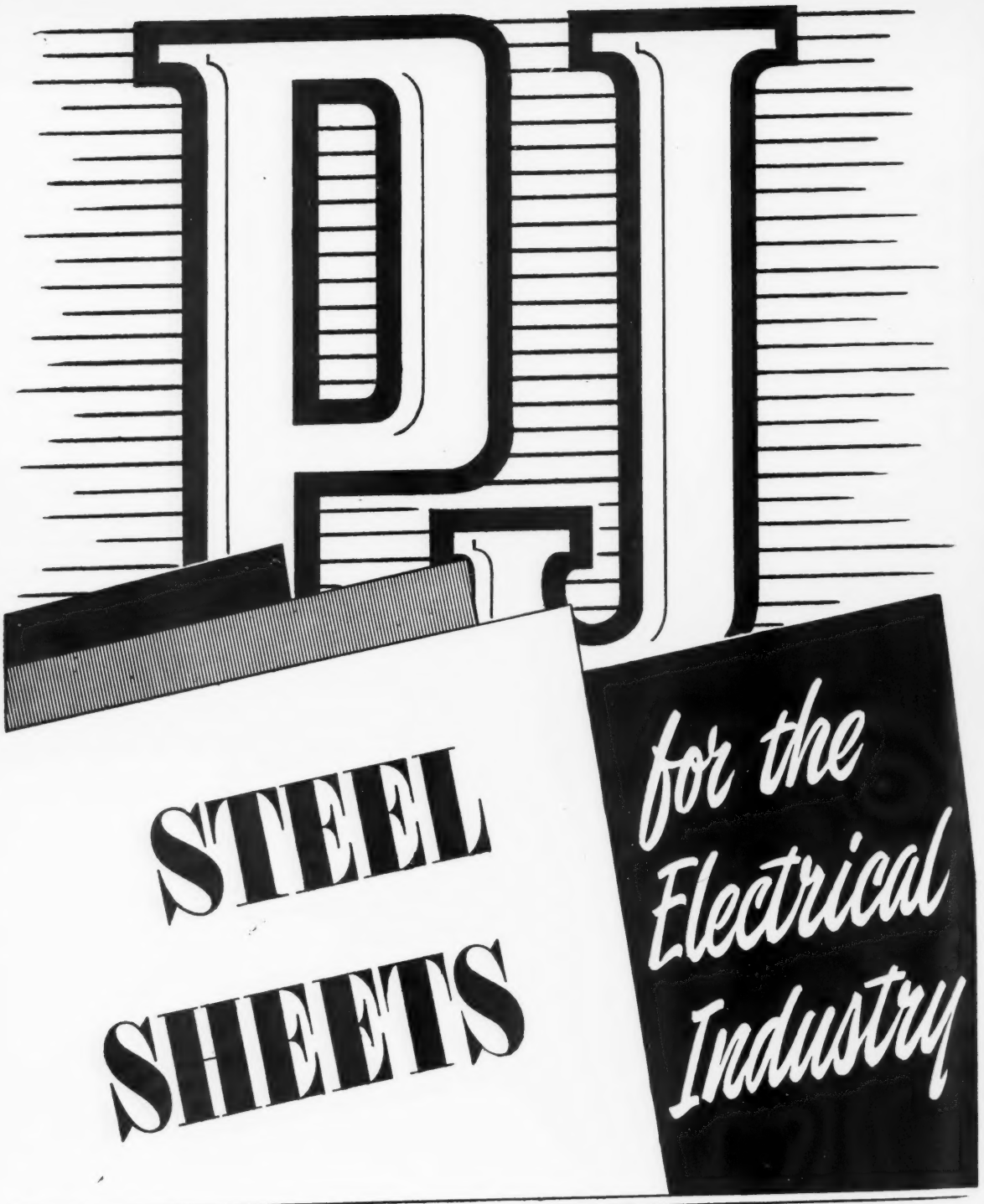

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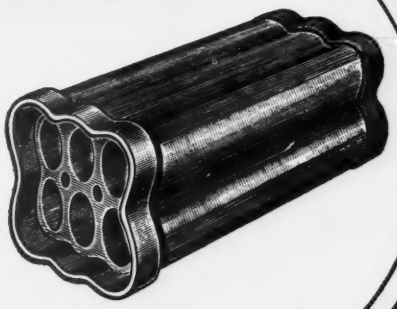

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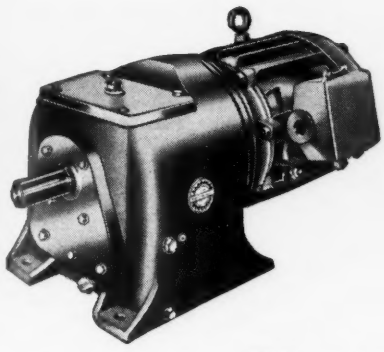

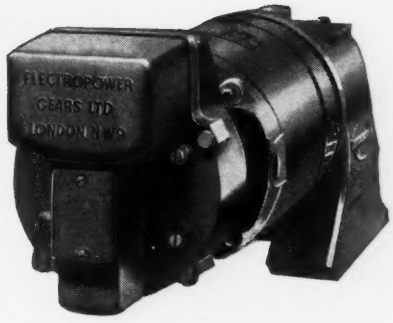

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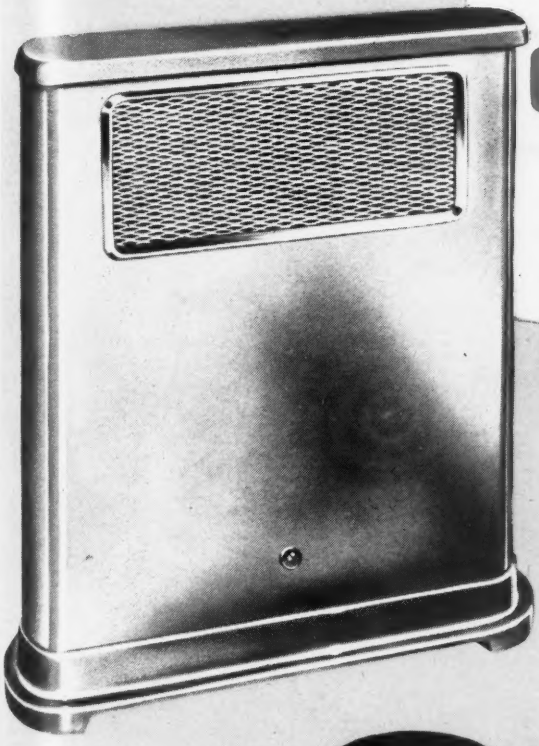

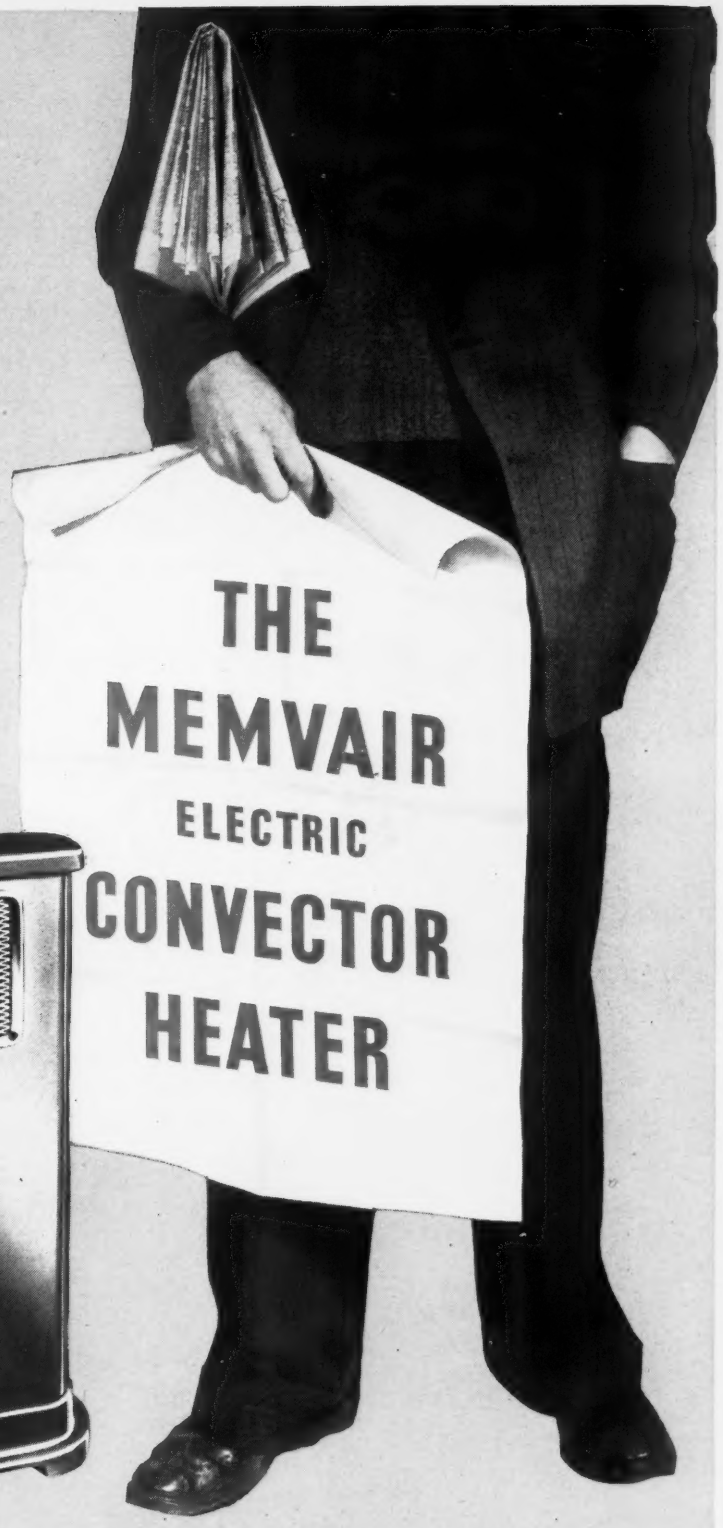

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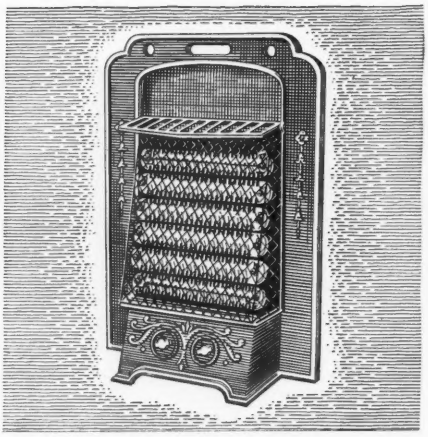

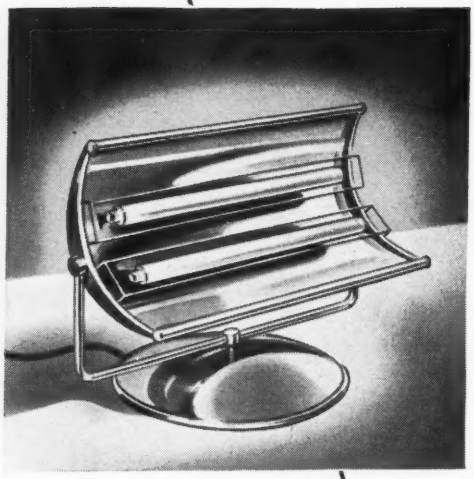

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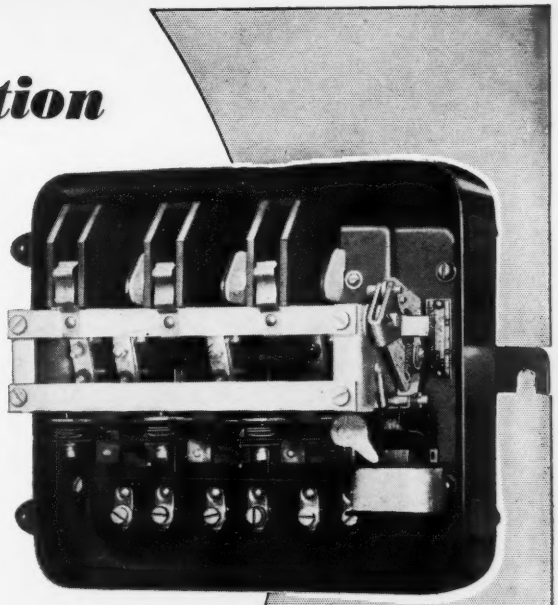

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RATING UP TO 40 AMPS. 500 VOLTS Double and Triple-Pole
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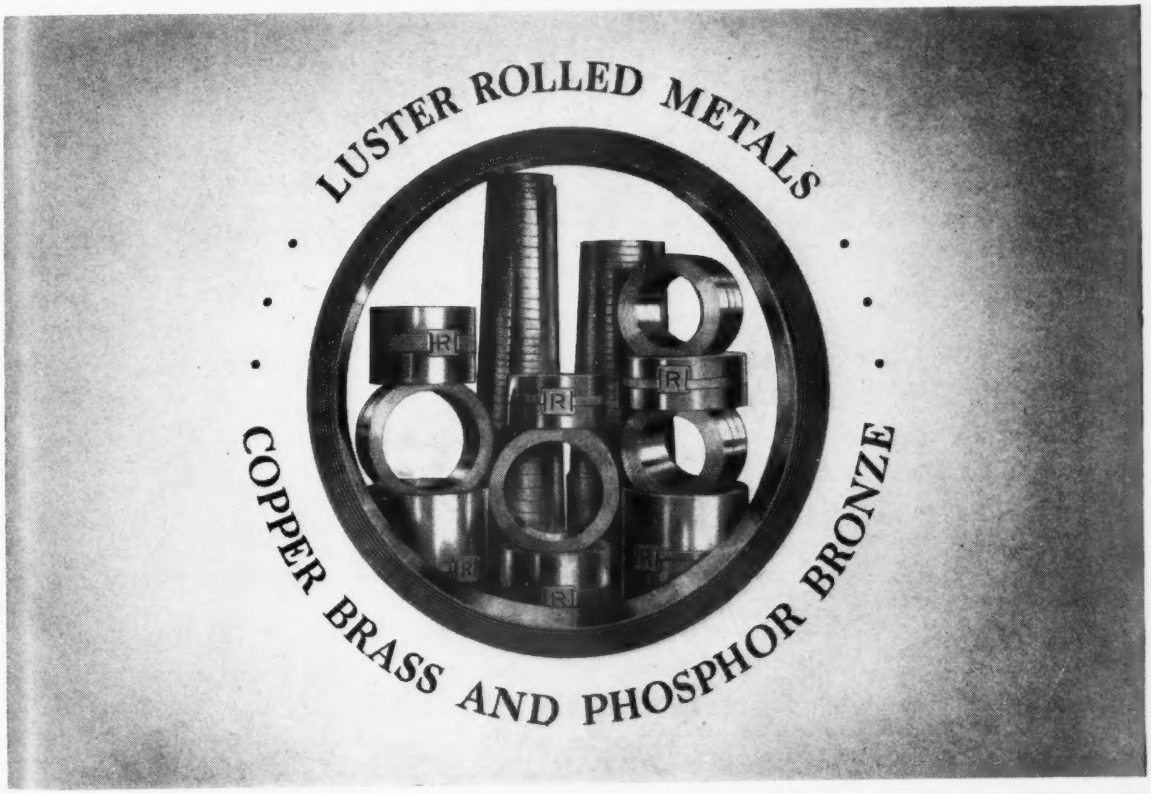

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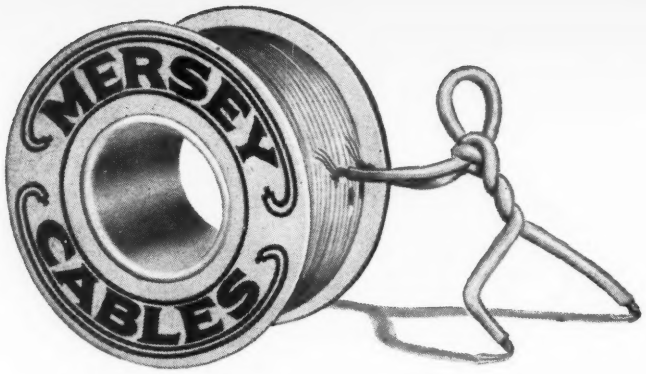

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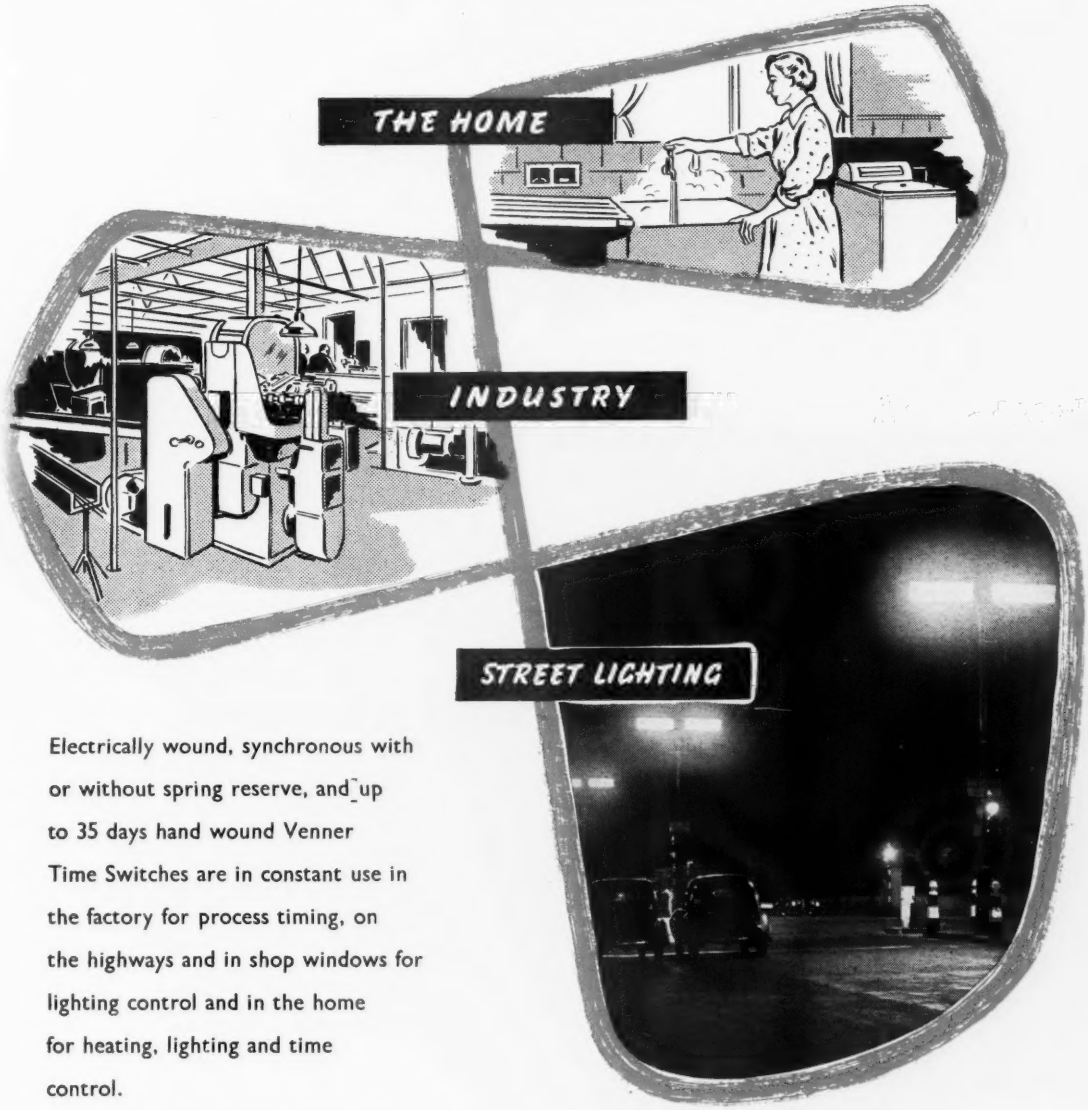

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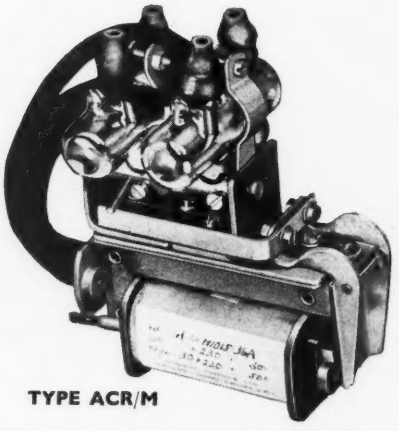

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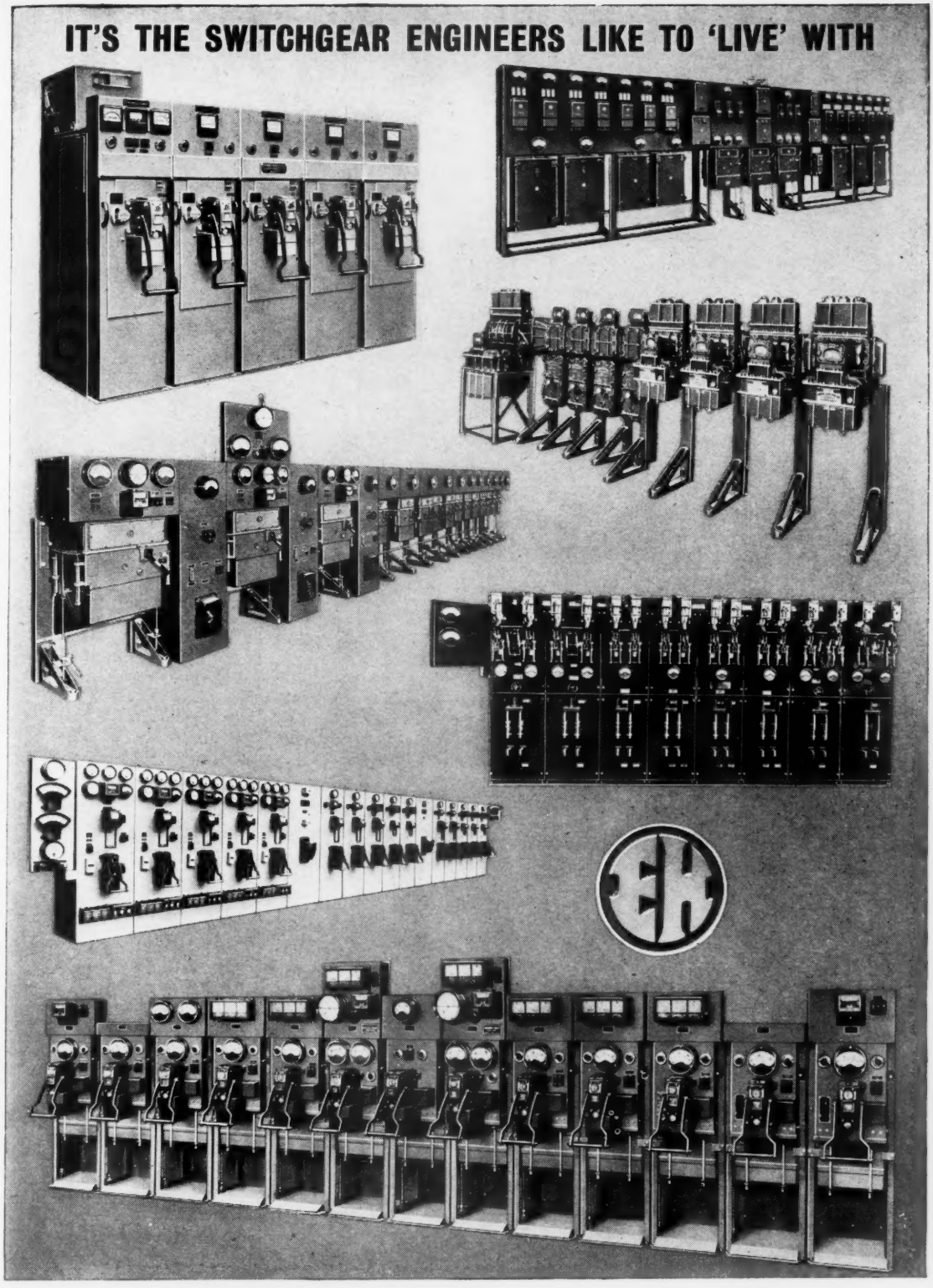

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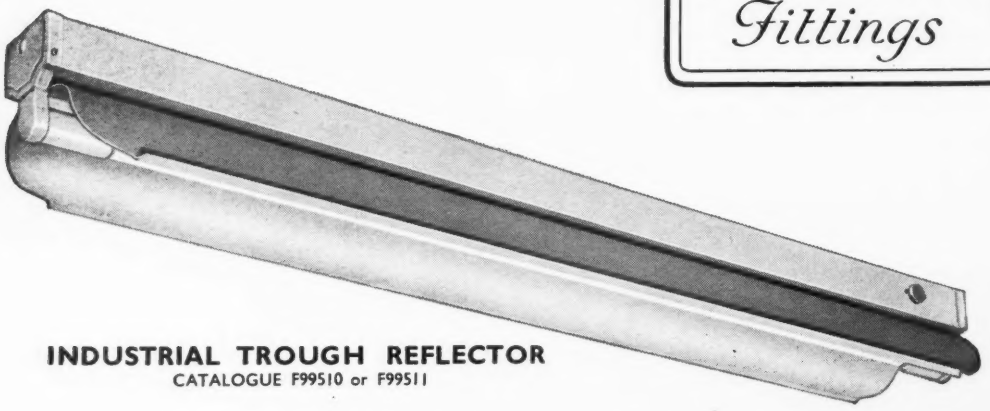

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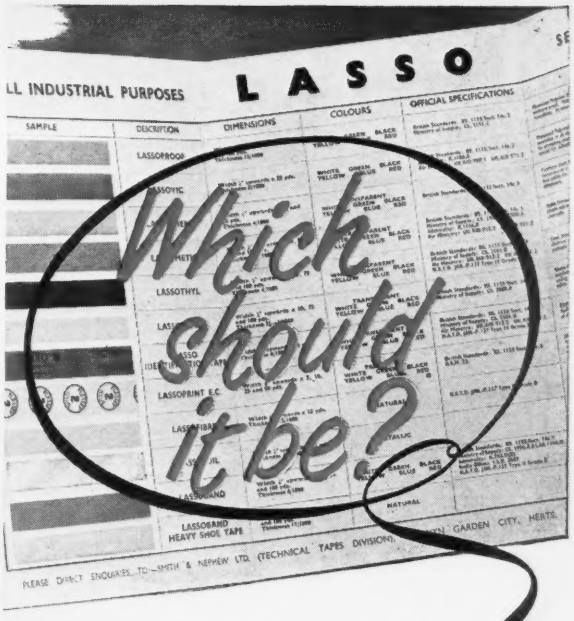

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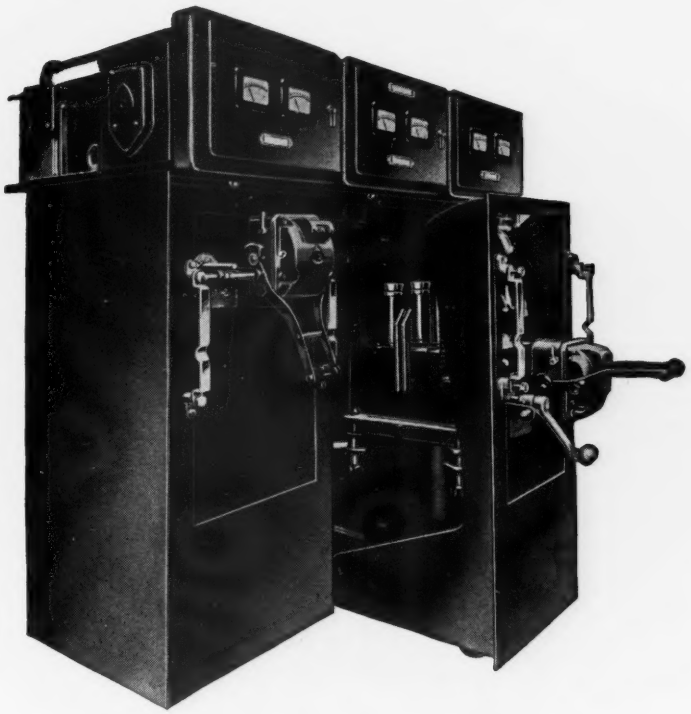

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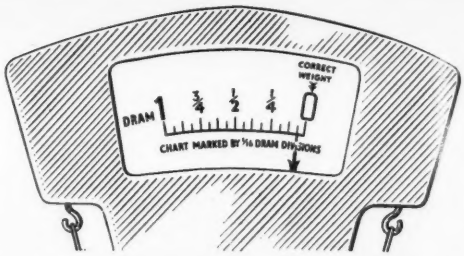

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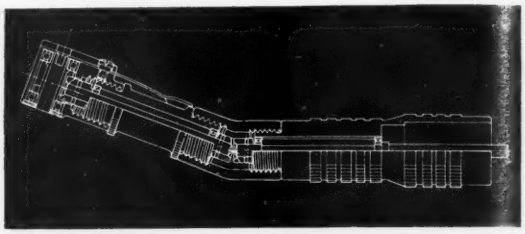

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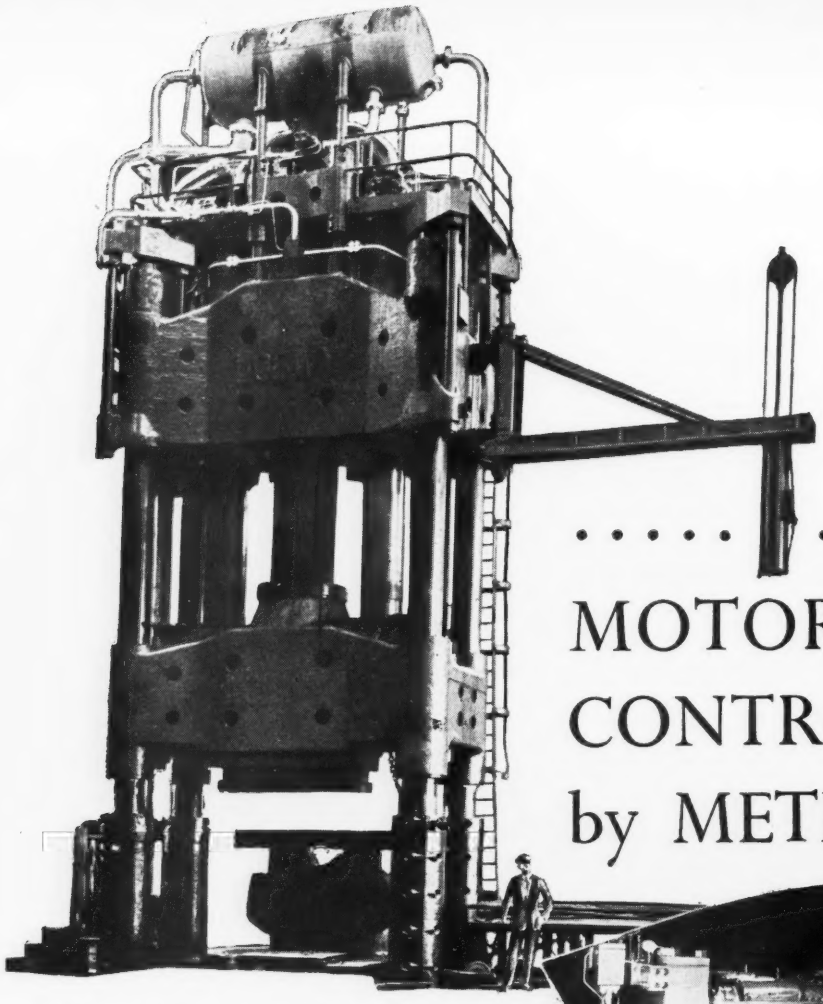
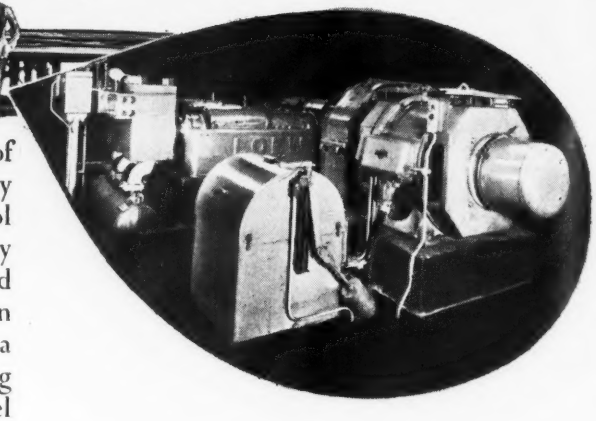


.....with MOTORS and CONTROL GEAR by METROVICK



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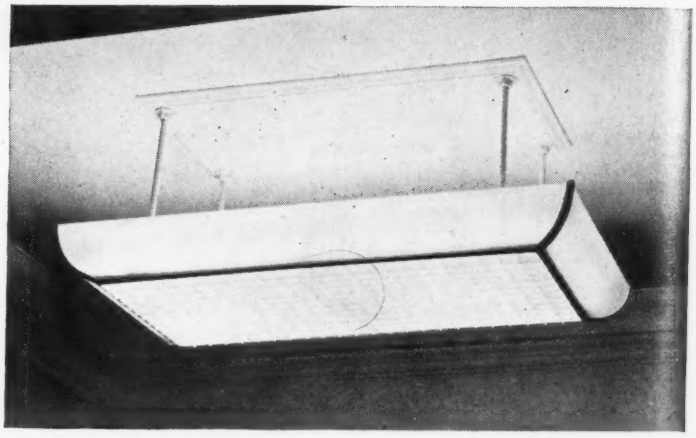

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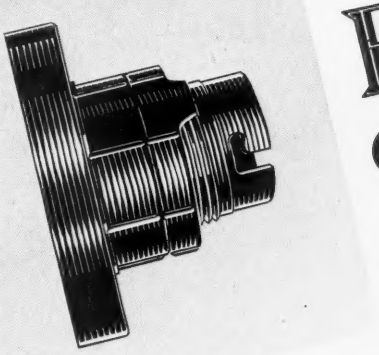

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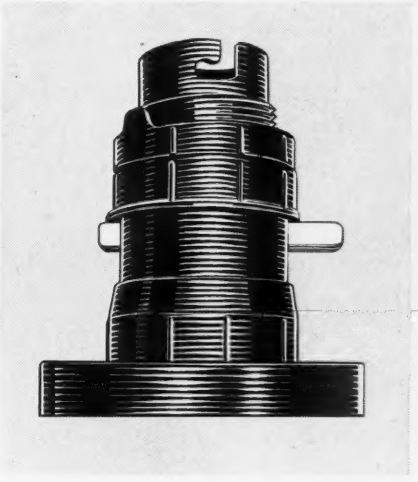

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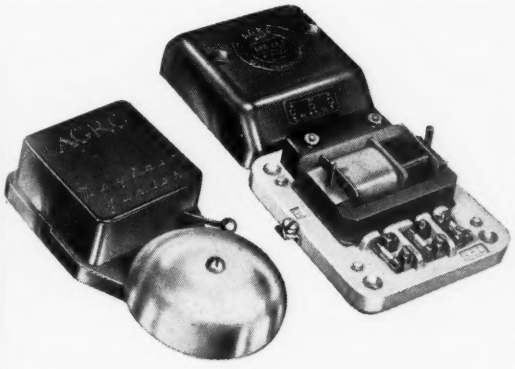

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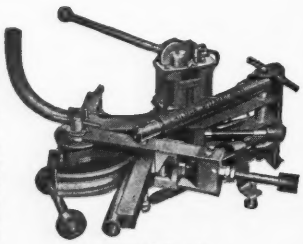

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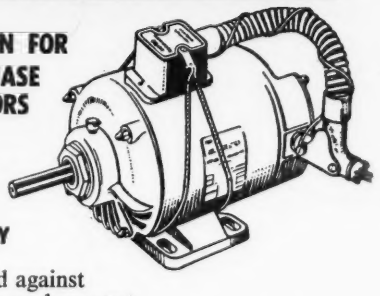

Otters guard against temperature and current overload, the starting current is carried by the thin Otter Bi-metal, which heats up more quickly than the motor windings. It cannot be fused.
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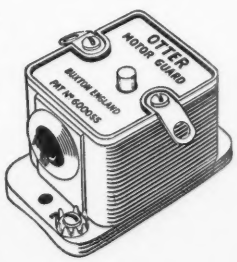

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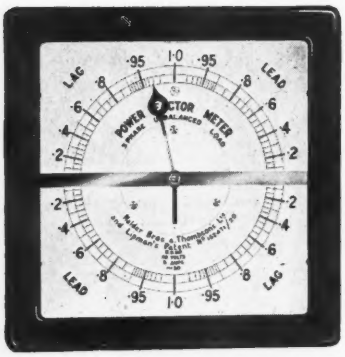

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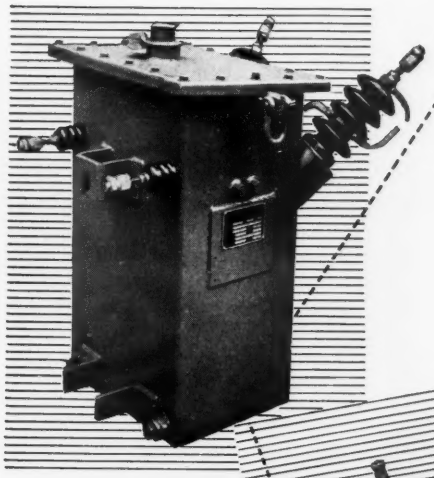
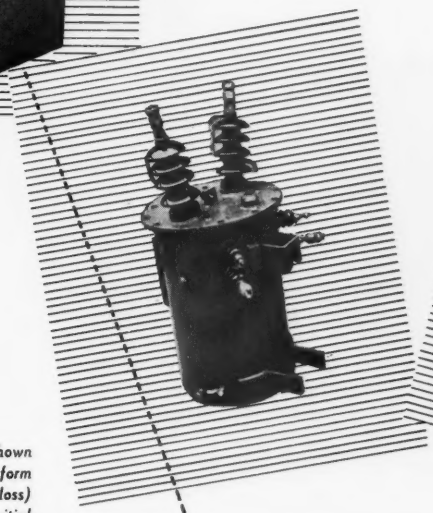
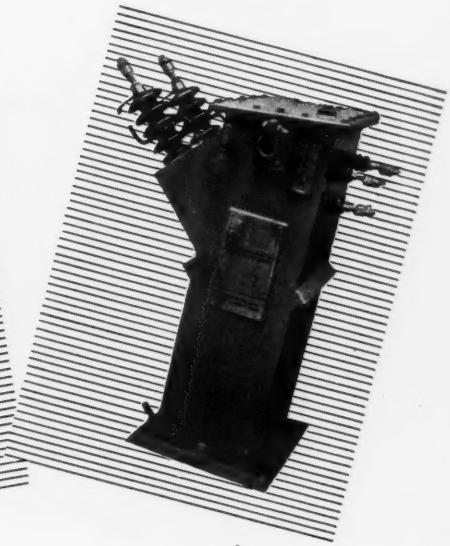


The 15 kVA "LOFEL" has an iron loss of only 80 watts, and is installed by Area Boards all over the country.



The 5 kVA size shown here in cylindrical form (40 watts iron loss) offers economy in initial cost. A rectangular type having an iron loss of 32 watts is also available.



The 25 kVA size (iron loss 120 watts) is shown here as a platform type; pole mounting brackets are, of course, also available.

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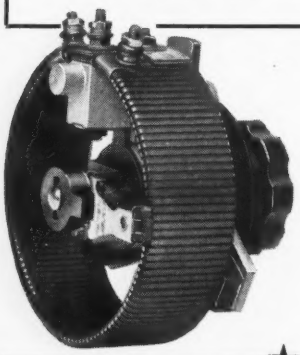

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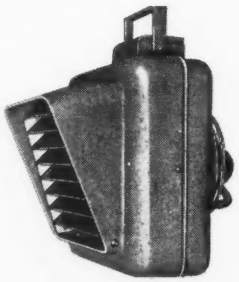

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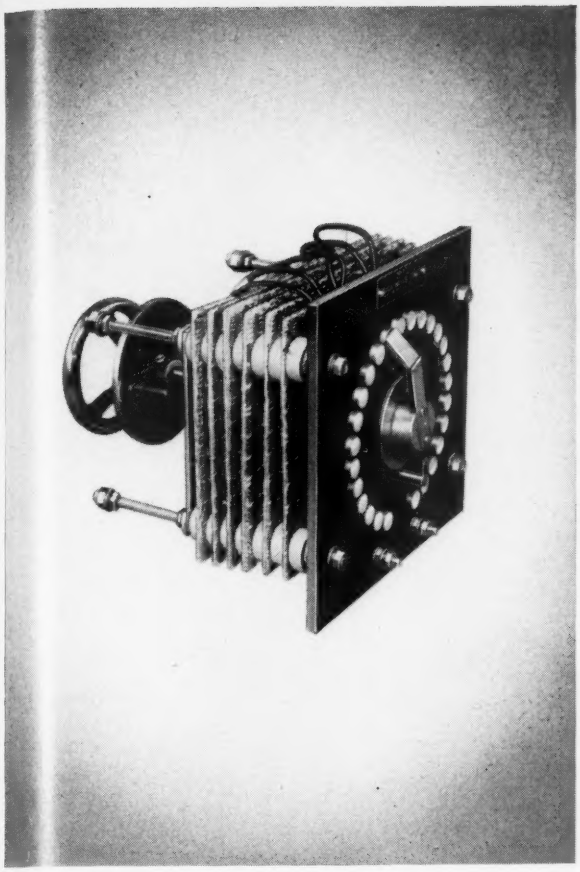

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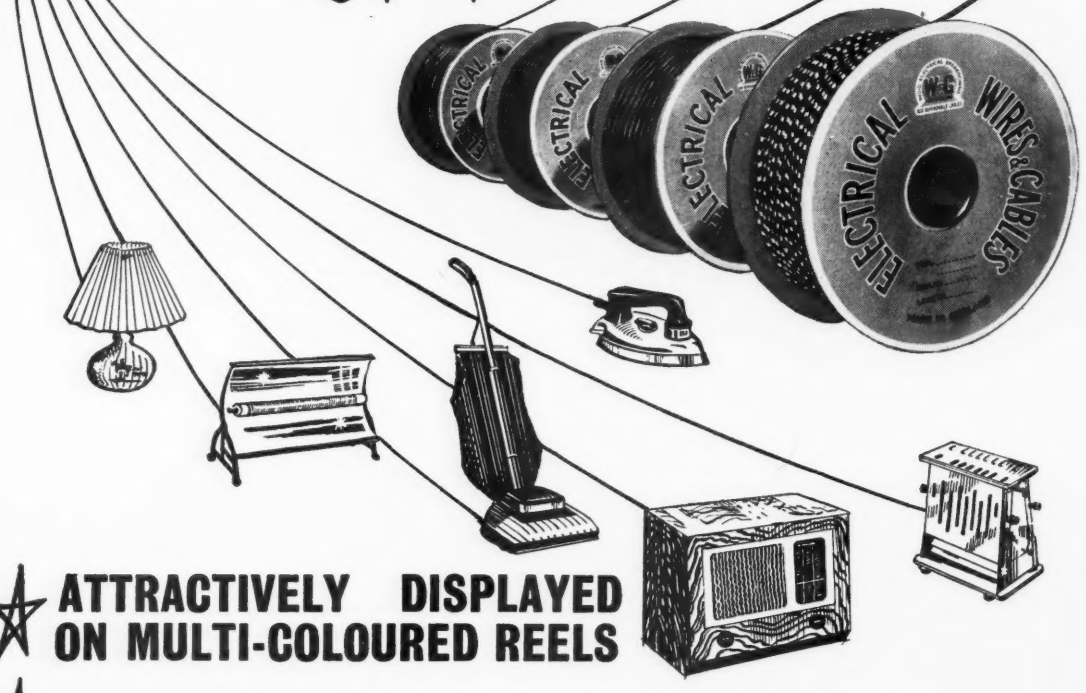

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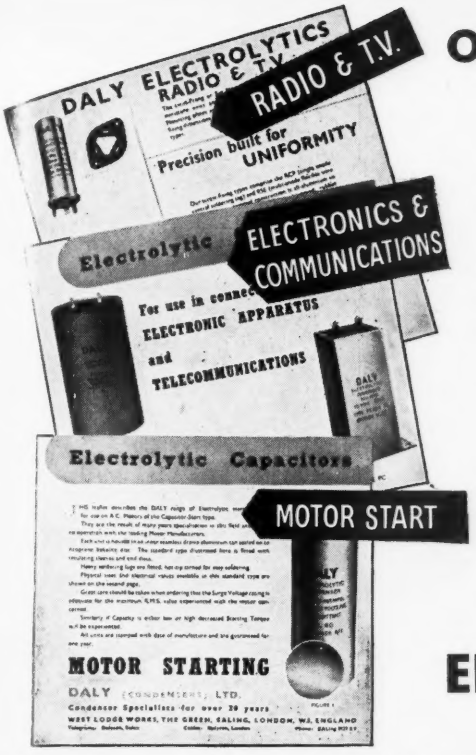

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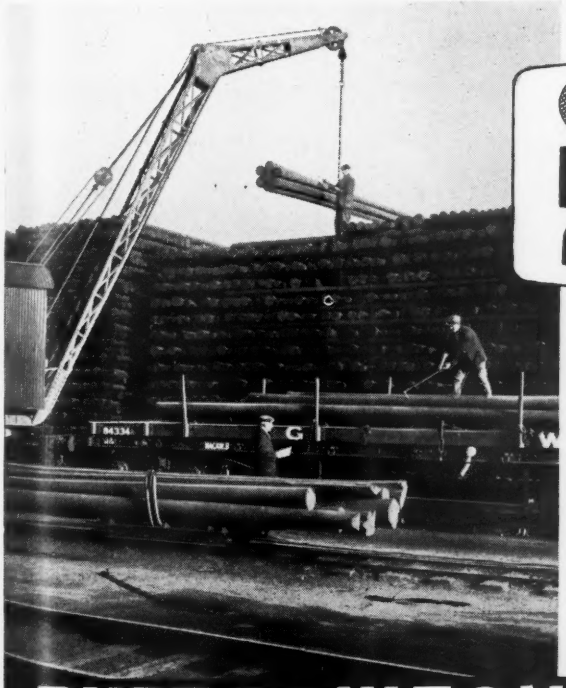

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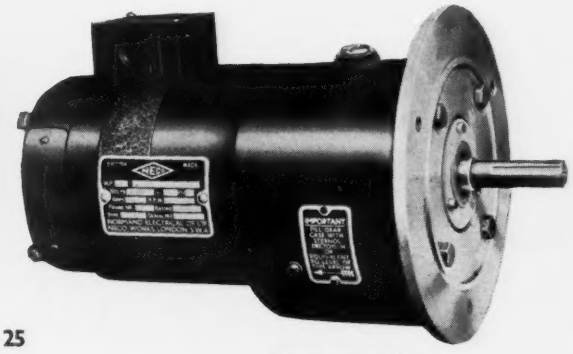

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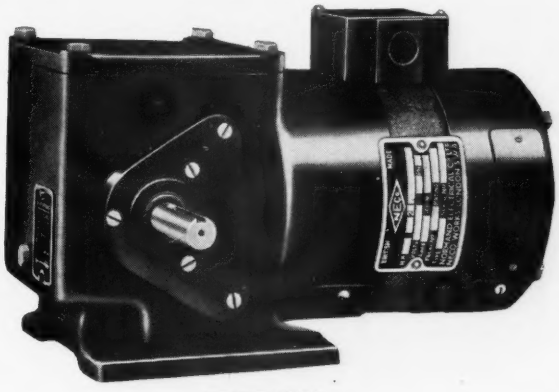

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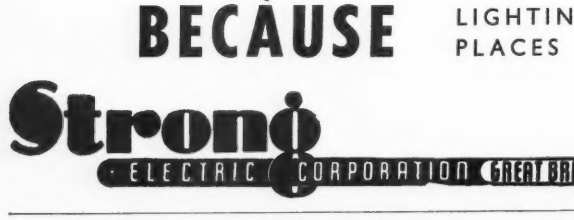

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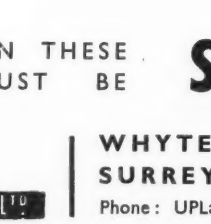

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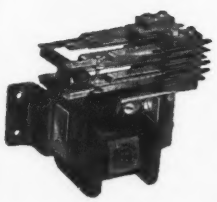

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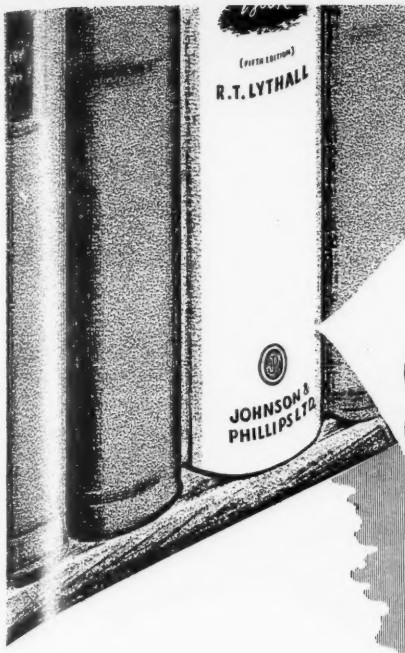

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30 JULY 1954

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VOLUME 155 ◇ NUMBER 5

Eighty-Second Year of Publication

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113 CLASSIFIED ADVERTISEMENTS
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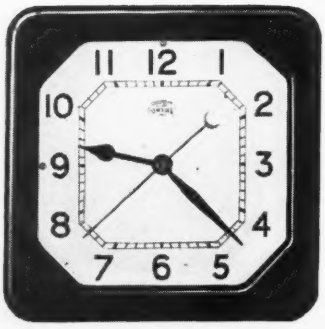
Timers and Timing



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ELECTRICAL REVIEW

30 July 1954 Vol. 155 No. 5 Established 1872

Price Questions

HOW much business is lost by the shyness or indefiniteness of sellers in the matter of prices? This is a matter upon which we commented a few months ago; so far we have not seen much improvement and we think it worth while to raise the point again. Sometimes when a number of articles appear in a shop window no prices at all are given. That is at least consistent, but it is also common practice among retailers to price a number of items in a window but to omit this information in the case of others—generally the more expensive looking. This is quite clearly a tacit admission that the price is rather high—possibly excessively high—and while the articles so distinguished may attract attention they certainly repel custom.

This reticence about prices extends to Press advertisements and to catalogues and leaflets. In a period of constantly-fluctuating prices it may be permissible so far as, say, half-yearly or annual catalogues are concerned, but there is no reason for omitting prices from ephemeral advertisements and leaflets. We think that candour is to be preferred and is more remunerative.

Another thing that is irritating to the would-be buyer is the way in which purchase tax is handled in advertisements. Too frequently the price of an article is given in bold figures with the addition in the smallest type of the purchase tax, which the purchaser has to pay anyway and should be shown quite plainly. This is the method of the London barrow boys when selling their wares so that what looks from a short distance like " 1s per lb " turns out on very close inspection to be " 1s 3d per ½ lb." The honest way is to give the total in plain figures with the amount of purchase tax included shown in parenthesis.

A further semi-deceptive practice is indulged in by firms offering hire-purchase terms. They label an appliance " Yours for 5s a week," leaving it to be discovered subsequently by the inquirer that this goes on for an inordinately long time and, moreover, there is an initial payment. Why should the sellers not say quite clearly what period is involved?

We are fully aware that " sales psychology " is the answer to these criticisms. The methods objected to are designed to attract attention and lure the " prospect " into the shop. Once in he can be worked upon by clever salesmen and persuaded into purchasing. It is a time-honoured system and no doubt is still effective in many instances. Nevertheless it seems to us that the public are becoming more sceptical and sophisticated and, as we have said, are as likely to be repelled as attracted. It is worth while trying methods less open to question.

RETAIL TRADE RETURNS

Although they are now probably more of historical interest than practical value the statistics relating to the 1950 Census of Distribution (referred to in this issue) show certain trends. It is perhaps useful to have a comparison of sales of radio and electrical equipment by electricity authorities with those by private retailers, although the comparison is somewhat befogged by the inclusion of a certain amount of electrical contracting work. With this qualification, it may be said that private establishments, numbering 9,346, had total sales of about £82 million in 1950, while 1,107 electricity showrooms reported a total of nearly £16 million. The "private" establishments included 62 co-operative societies with sales of £928,000. The extent of sales of gas apparatus cannot be accurately determined, but it is noted that in 1950 a total of 1,347 gas showrooms made sales to a value of nearly £23 million. Over half of the electrical retailing establishments included in the returns (about 5,000) had an annual sales figure of under £5,000 but their turnover (£10·7 million) represented only about 13 per cent of the total.

FLOW-LINE PROCESSES

We think it can be safely said that generally modern materials handling systems have contributed more to increasing production than any other industrial development, particularly in the lighter industries. This has led to the rather misleading idea that the mere establishment of a materials handling system (a conveyor belt scheme is a simple example) is all that is necessary to the success of any production increasing scheme. The vital point about a genuine materials handling scheme is the dovetailing of different processes into the handling scheme proper, and this entails as much ingenuity on the part of those responsible for the factory planning as does the lay-out of the conveyor system itself. Three examples of production equipment come readily to mind in this connection, namely, h.f. induction heating apparatus, resistance welding machines and plating plants. They are all essentially electrical and the skill with which manufacturers have adapted them to flow-line production is indeed remarkable.

ELECTRONICS IN INDUSTRY

At the recently held Oxford conference of the British Institution of Radio Engineers there was much discussion as to whether or not electronics was the key to improving and increasing production. There are still, unfortunately, quite a few people in industry who believe that if one answer to a problem involves the use of electronic equipment it is the only answer worth considering. They are just as wrong as those people who use electronic apparatus just for the sake of using it or because they imagine that it possesses some sort of industrial magic. After all, there are many ways of solving problems without resort to electronics particularly when operation and maintenance by engineers with but a sparse knowledge of radio type apparatus is considered. This, however, does not mean that one should fight shy of electronics, for many industrial problems can only be solved reasonably by the use of this type of equipment, but one must be careful to keep these techniques in their proper perspective with other and perhaps more well-tried methods. Another difficulty which was brought out at the conference, was that while radio proper has been entirely in the hands of radio engineers in its application and development, electronic applications are invariably in the hands of the "old-fashioned" men who have been trained as electrical or mechanical engineers.

NUCLEAR POWER IN BRAZIL

Many papers discussed at the World Power Conference now meeting in Rio de Janeiro, as reported in this issue, appropriately relate to power resources in tropical and semi-tropical regions. While a few are concerned with natural resources which may prove useful on a comparatively small scale in certain circumstances, none appears to have dealt with atomic energy with its promise of yielding vastly greater results in a less remote future. In view of the recent discovery of uranium and thorium in Brazil, some account of the experimental atomic power station to be built in Minas Geraes within the next five years would have provided additional evidence of the Brazilian Government's realization of the primary necessity of adequate electricity generating capacity in furthering the prosperity of a country.

POWER STATION SIMILARITIES

Technically and operationally there is nothing so false as the idea that modern power stations are becoming standardized; indeed the impress of local conditions is greater as the power station becomes larger. True the housings of modern turbo-alternator sets, particularly when complete with their lagging, tend with time to become more and more alike with the inevitable result that in general appearance many turbine room interiors are very much alike. This likeness is strongly emphasized in the case of the unit operated stations which are characterized by the absence of the partition wall between the boiler house and turbine house, e.g., Little Barford, Llynfi, Earley, Littlebrook "B," and now Rye House, which was officially inaugurated and described in last week's *Electrical Review*. But despite this similarity the layouts and the operation of Rye House and, say, Littlebrook "B," are strikingly different.

HUNGARIAN TROLLEY-BUSES

In view of London Transport's decision against the retention of trolley-buses in its system it is of interest to learn that a hundred trolley-buses are being manufactured in Hungary for service in Budapest. Others are being made for Pécs in South Hungary where four routes are being equipped. The official announcement of these developments also refers to an unusual hybrid which is being produced in Hungary. This is a vehicle which is designed for use either as a trolley-bus or a diesel-operated bus. It is said to be equipped with an 86 kW motor and with a 125 h.p. water-cooled six-cylinder diesel engine; sixty passengers are accommodated.

World Power Conference

Papers Presented at Sectional Meeting in Brazil

A LARGE proportion of the papers presented for discussion at the Rio de Janeiro sectional meeting of the World Power Conference (presided over by Dr. A. J. Alves De Souza, chairman, Brazilian National Committee), of which preliminary particulars were given in the *Electrical Review* of 16th July, related to technical and economic problems of hydro-electric systems supplemented by thermal power stations or by electrical connection with neighbouring countries. The peculiar importance of the subject for tropical and semi-tropical countries is apparent from Fig. 1.

In Sweden, where water power (4,000 MW installed) normally provides 95 per cent of the output (20,600 million kWh in 1952), these resources have an ultimate capacity of 150,000 million kWh, of which 60,000 million could be economically exploited (Petri and Langstrand). Almost all falls in the south have been harnessed and seasonal and daily flow is regulated by lakes. Back-pressure plant (150 MW), mostly in pulp and paper industries, yields 3 per cent of the national output. Public supply thermal stations are condensing and contain 750 MW, mainly concentrated in four stations near load centres, which burn imported coal and oil. Normally steam stations carry the peaks, but in times of extreme water shortage when the flow has been reduced to two-thirds of normal (about every fifth year) they run on base loads, but even then their output does not exceed 9 per cent of the total. Boiler pressures are low (350 and 500 lb/sq in at the largest station, Vasteras, 220 MW) for quick starting (30 to 60 min from cold). The Oresund station in Malmo, however, which was started in 1953, has steam conditions of 1,150 lb/sq in and 930 deg F. At the present average rate of load increase of 6·5 per cent per annum, water power will be fully utilized by 1970. Up to that time about 300 MW of hydro plant is to be installed each year and 50 MW of condensing plant. Afterwards the most efficient modern steam plant will deal with the base load.

In India, where in 1951 water power stations contained 30 per cent of the installed capacity and generated half the kWh used, it is deduced (Gadkary) by examples taken from the Damodar Valley (West Bengal) and the Tata (Bombay) systems that maximum benefit comes from interconnecting hydro and steam installations only when an integrated development is planned. Damodar, with four stations, has an installed capacity of 290 MW (140 MW hydro) and the second has 310 MW (270 MW hydro) in three stations making it the largest energy producer in South-East Asia. The relative base-load and peak duties of the two types of station are determined by total rainfall and monsoon conditions. The paper also reviews the distribution of hydro and thermal power resources in India as a whole and the conditions governing the possible extent of co-ordination.

A study of conditions in Japan (Noda) attempts to ascertain the amount of firm power obtainable by supplementing hydro power from natural stream flow with thermal power. For each 100 MW of constant maximum demand throughout the year, minimum generation initial cost would be obtained without storage when hydro capacity was 90 MW and thermal 70 MW, whereas with storage these values would be 90 and 40 MW.

The situation in Italy is governed by the consideration that 60 per cent of usable water resources, estimated as capable of producing 50,000 million kWh per annum, have already been harnessed and with a growth of consumption of 6 to 7 per cent per annum will not meet load increases for longer than ten years. It is estimated that next year the effective power of hydro-electric works will be

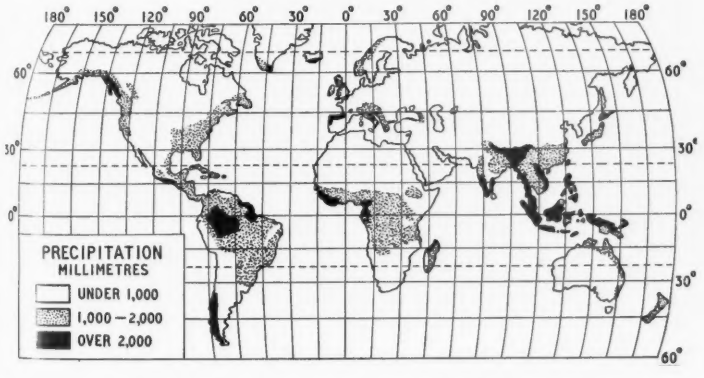


Fig. 1—Mean annual moisture precipitation in the world (Sexton)

9,500 MW, generating 33,000 million kWh with a reservoir capacity of 4,000 million kWh; thermal stations will have an output capacity of 2,500 MW. The trend is towards augmenting hydraulic and thermal production in the same proportions, to build new hydro plant for peak load and frequency regulation, and to add to existing hydro stations sufficient reservoir capacity to increase their outputs. New thermal plants will be designed to use pulverized high-ash coal of low calorific value, naphtha or methane. Steam conditions will be 850 lb/sq in and 850 deg F for annual operation of 2,000 to 3,000 hours and 1,775 lb/sq in and 970 deg F above 3,000 hours.

In the three Faroe Islands (Hjorth, Denmark) an initial 2,500 kW Pelton wheel at Vestmanna will be put into service to supply from two reservoirs 8 million kWh/annum for transmission at 20 kV. It will be linked with an existing 900 kW diesel installation at Thorshavn. Total consumption within the next few years is forecast at 15 million kWh. Waterfalls have an estimated capacity equivalent to more than 30 million kWh.

Five Brazilian papers deal with various aspects of the Sao Francisco scheme, to which reference was made in the *Electrical Review* of 16th July. The first (Ferraz) deals with the construction of the underground Paulo Afonso power station, which utilizes a 270ft fall and shelters two 60 MW sets with provision for a third. Two further stations of 360 MW each will later be added. Two 220 kV transmission lines have been taken from an adjacent outdoor substation to Recife (25 MW) and Salvador (20 MW), 250 and 275 miles away. Two other papers describe the excavation methods adopted (Marchetti) and the novel types of cofferdam built (Balanca).

Basic characteristics of the lines referred to were worked out with the aid of a miniature replica of the system, using 100 kVA machines, and an a.c. calculating board which indicated 230 kV as suitable initially (Griscom and Ferraz). As the lines might have to be charged by one generator, the short-circuit ratio of each was 1·98. To avoid dangerous overvoltages when re-energizing a tripped open-circuited line, the two synchronous machines which, with automatic voltage regulators, are installed at each of the main receiving substations, can be started across the line, their locked rotor reactance acting as a large shunt reactor for a sufficient time for the voltage to become stabilized. For charging the two lines the 145 MVA required can be provided by: one Paulo Afonso generator, 96 MVA; two Recife frequency changer motors, 2×5; two Recife shunt reactors, 10, one Salvador synchronous condenser, 10, two Salvador shunt reactors, 10, total, 148·5 MVA. Circuit breakers are rated at 3,500 MVA at 196–230 kV and have a clearing time of 3 cycles. Star-delta transformers are used with solidly earthed neutrals, the 230 kV windings being connected in star. Carrier relaying is employed.

A study of technical and economic aspects of power transmission in Brazil (De Mello) centres round a distance of 200 miles between a remote generating site and a metropolitan system. Especial reference is made to the use of shunt breaking resistors at the sending end to be switched in within 6 cycles after the occurrence of a fault as a supplementary means of maintaining stability. The economics of alternative schemes are worked out for loads of 400, 600 and 800 MW at different voltages.

The benefits that have accrued to Austria and its neighbouring countries through the subordination of national territorial claims on water to technical and economic considerations forms the subject of a paper (Urban and Vas) dealing with schemes existing and projected which aim at full utilization of the resources of the Alps (Fig. 2). This tendency has resulted in many cases in the formation of internationally owned companies. The principles of such agreements and industrial arrangements apply to both " successive " waters, which traverse more than one state and " contiguous " waters, which form the boundary between states. The countries concerned in this co-operative scheme besides Austria are

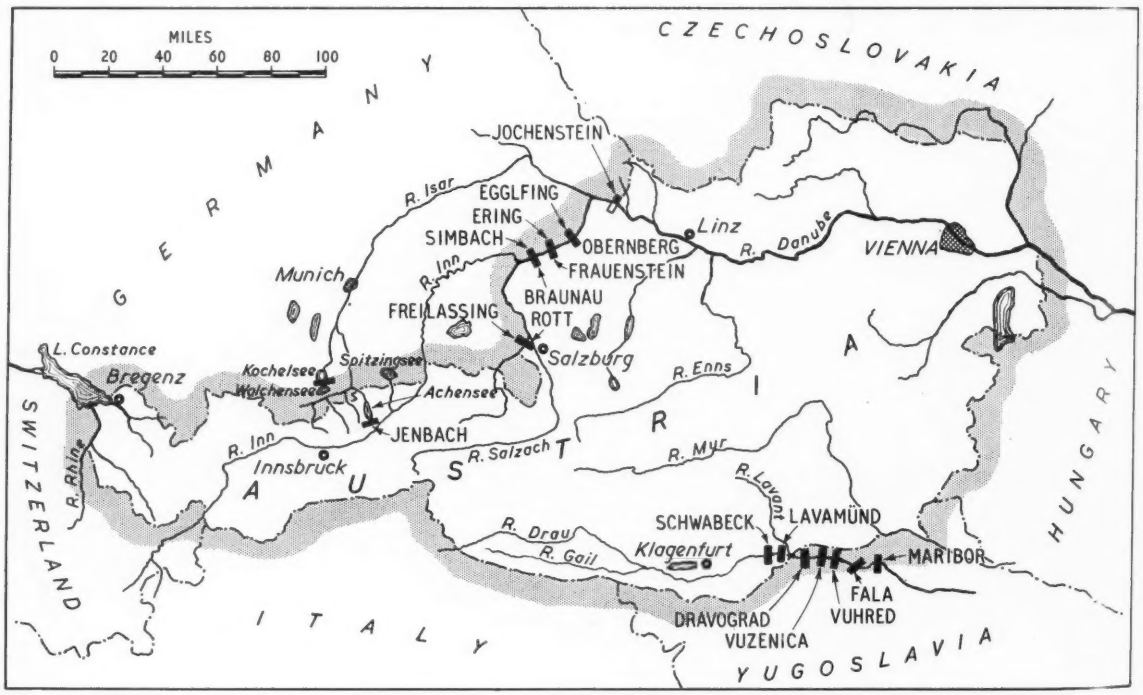


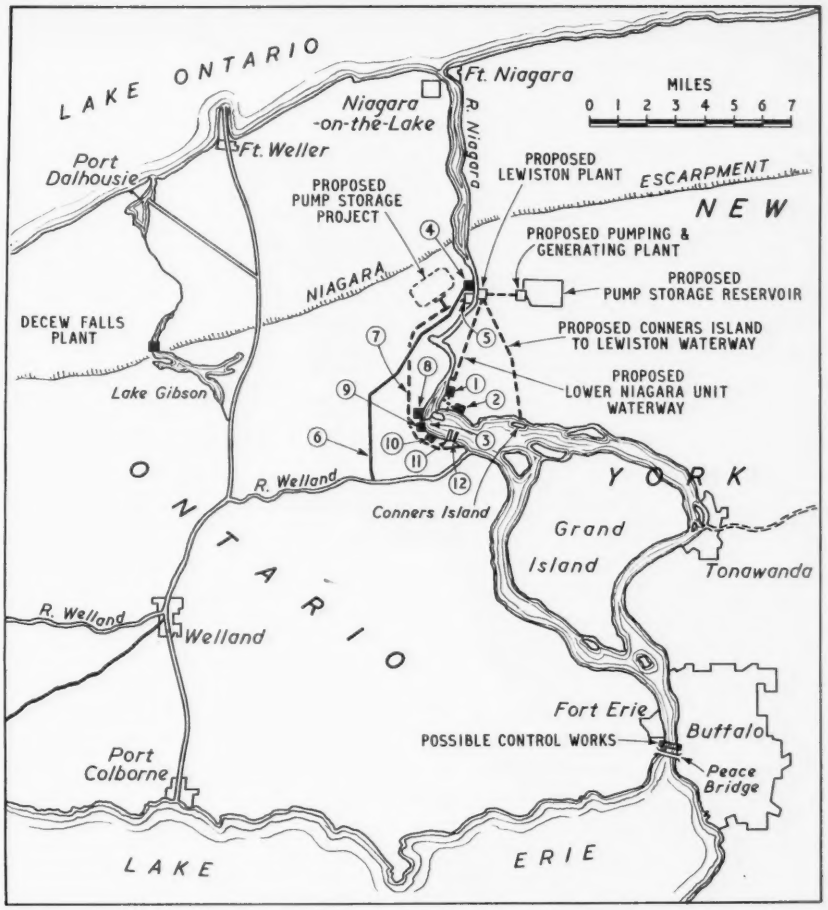
Fig. 2—International development of Austrian water power

Germany, Jugoslavia, Switzerland and Italy.

A similar realization of the advantage of international arrangements is shown in a plan for the joint usage of Lake Titicaca by Bolivia, Chile and Peru when the economic capacity of these countries makes it feasible (Harnecker, Salazar and Santa Maria of the Chilean National Committee). The waters would preferably be diverted to the Pacific rather than to the Atlantic for irrigation and industrial uses as well as the yearly production of 17,000 million kWh.

Agreements between Canada and the U.S.A. regarding the use of the 315ft falls at Niagara and of the Great Lakes, including the preservation of amenities, and a chronological account of developments is presented in another paper (Adams, U.S. National Committee). At present Canada has in hand an extension of hydro-electric capacity by 1,375 MW and the U.S. is awaiting Government sanction for an extension of 1,330 MW (see Fig. 3).

Another paper (Dexheimer), which relates to water agreements by the U.S.A. with Canada and Mexico, mentions that there are in existence more than 100 bilateral and 10 multilateral conventions in the world, made out of sheer necessity, for the control of water resources.



(1) Existing Schoellkopf station. (2) Existing Adams station. (3) Niagara Falls and cascades. (4) Existing Sir Adam Beck No. 1 station. (5) Sir Adam Beck No. 2 station under construction. (6) Sir Adam Beck No. 1 canal. (7) Sir Adam Beck No. 2 waterway. (8) Existing Ontario station. (9) Existing Rankine station. (10) Existing Toronto station. (11) Chippawa Grass Island control structure to be constructed. (12) Existing submerged weir

Fig. 3—Proposed redevelopment of Niagara on the U.S. side (Adams)

The influence of tropical and subtropical climates on the design of electrical equipment, other than for power stations, is covered in a paper contributed by members of the British Electrical and Allied Manufacturers' Association (edited by H. Astbury). Conditions to be provided for vary in extremes of heat and of atmospheric humidity and dryness. Except in deserts, an ambient temperature of about 40 deg C may be assumed for indoor equipment and 75 deg C for outdoor equipment exposed to direct sunlight, which may entail the use of insulating materials that are capable of withstanding high temperatures continuously or, alternatively, the derating of apparatus.

Component parts, such as capacitors, which are sensitive to temperature, must be protected from heat conduction from associated apparatus. Mechanical stresses due to temperature variations in the 24 hour cycle must also be provided for. The effect of heat on changes in resistance of windings of instruments and relays, on permanent magnets, and on control springs and metal rectifiers has also to be taken into account. Transformers and motors that are continuously operated in direct sunlight are usually derated. Motors of less than 1 h.p. are preferably rated on the basis of the total temperature on site.

High relative humidity is responsible for most electrical troubles in the tropics. Moist air penetrates even totally enclosed motors, e.g. through bearings, and condenses inside, calling for the use of relatively moisture-proof materials. Instruments and small transformers may need to be hermetically sealed.

Fungus growth is unlikely to occur during normal operation, but may rot insulation during transport in ships' holds or during storage in badly ventilated enclosures. Rodents and insects can eat through insulation and lead sheathing of cables. Wasp nests built within enclosures have caused failure of tripping mechanism on oil circuit breakers, but total enclosure of equipment or covering ventilation holes with fine mesh screens provides a remedy. Attacks by termites on lead sheath, paper and compound of underground cable may be prevented by having a heavy overlap armour and by protecting the joints with a glycerine-arsenic mixture.

Apart from temperature, direct sunlight, which may average ten hours a day throughout the year, affects exposed rubber and paint finishes. Prevailing winds from the sea are liable to have a high salt content owing to rapid evaporation at high temperatures, thus causing corrosion and surface leakage of electricity. In hot dry seasons dust-proof enclosure of components may be necessary.

In humid atmospheres contact between dissimilar metals

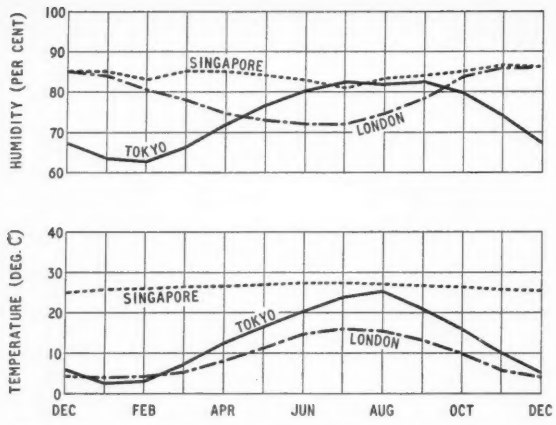


Fig. 4—Typical local variations in temperature and humidity during different times of a year

may lead to severe electrolytic corrosion. Tin-based alloys should if possible be substituted for zinc alloys. Springs should be of non-ferrous alloys, such as cadmium copper or phosphor bronze, or if of steel they should be zinc or cadmium plated and treated with a hard but resilient lacquer. Aluminium and most copper alloys exhibit relatively good corrosion resistance.

Absorbent cellulose insulation, e.g. cotton or paper, needs to be impregnated with varnish to avoid deterioration from moisture, fungus and insects. Modern alkyd or oil-modified phenolic varnishes and, for stationary windings, vacuum impregnation with solventless varnish have proved reliable. Adequate surface-sealing with varnish is essential. Class " B " insulation (glass, asbestos and bonded mica) is usual for high temperatures. Oil for lubrication is becoming more common than grease. The paper also contains notes on packaging and protective finishes and on treatment of special problems.

How the relationship between humidity and temperature may vary from place to place is shown in Fig. 4. This is taken from a paper which deals with conditions in Japan, and pays particular attention to the prevention of moulds and describes methods of nitrogen sealing (Miyamoto). The Italian view (Signorile) is that electrical machines for tropical climates are fundamentally ordinary machines improved mechanically to resist corrosion and electrically to secure freedom from damage by moisture, mould and parasites. For ratings of less than 5 kW totally enclosed construction is held to be advisable.

In a comprehensive French survey of the requirements for the production and transmission of electricity in the tropics (Level), particular reference was made to the protection by electroplating of large metal surfaces. Water power in the tropics is usually subordinated to irrigation (Sexton, Canada). The advantage of the absence of ice is often offset by high floods, hurricanes, silt and evaporation. Underground power stations sometimes afford the best protection of equipment against floods. Usually the reservoir volume should allow for a reduction through silting of less than 0·5 per cent per annum.

Thermal plants in the Carribbean and Central America (Carruthers, Canada) have to cope with very sharp evening peaks within 2 or 3 min after sundown and lasting for about an hour, after which there is an even more precipitous decline. Structures may in some areas have to withstand winds up to 250 km/hr. High wet-bulb temperatures usually preclude the use of cooling towers and, when water is scarce, diesel engines, which require only 20 per cent of the quantity offer advantages in capacities up to 10 MW. Shell fish can be exterminated by periodic reversal of circulating water flow at salt water sites. Transport difficulties may prevent the use of components above a certain size. Other aspects of thermal power plants are summarized in a Belgian paper (Wilwertz), which includes a discussion of the potentialities of gas turbines.

British developments in gas turbines are described in a paper by Roxbee Cox (Ministry of Fuel and Power), Bowden (C. A. Parsons), R. J. Walsh (English Electric Co., sponsored by B.E.A.M.A.), and Hawthorne (Cambridge University). Thirteen companies in Great Britain are manufacturing complete industrial units—nearly as many as in the rest of the world combined and covering a wider range of powers and types. Representative smaller gas-turbine driven generators include 50 h.p. Rover "Neptune" engines (weighing 100 lb) for emergency use, Allen 150 and 1,000 kW and Ruston and Hornsby 900 kW units. A 2,000–2,500 kW class is made by English Electric, Metropolitan-Vickers, Parsons, B.T.H. and Brush.

Two B.T.H. 2,500 kW single-line units are being built for Nairobi South power station, Kenya. In larger outputs a 12,500 kW John Brown closed-cycle design is being installed at Dundee. Open cycle machines vary in design. For the Metro-Vick 15,000 kW set in service at Trafford the alternator is driven from the l.p. compressor shaft, while for the Parsons 10,000 and 15,000 kW sets it is on the h.p. compressor shaft. The English Electric 20,000 kW unit differs from both in having no heat exchanger, but uses a higher pressure ratio to secure thermal efficiency. The 3,000 h.p. gas-turbo-electric locomotive of Metropolitan-Vickers, which was put into service more than two years ago, is the most powerful in Great Britain. A locomotive to burn coal has been ordered from Parsons. The paper also gives particulars of numerous types of gas turbines without electric drives, especially those for aviation.

Industrialization in the Tropics

Trends and characteristics of industrialization in the tropics (which contain 35 per cent of the world's population and produce 2 per cent of its electricity) are analysed in a paper (Verteuil, France) which briefly summarizes the major mineral resources, which have hitherto taken second place to agricultural products in the use of electricity. Low-cost water power would allow great developments of metallurgical and chemical industries utilizing local products.

In a study of the economic aspects of wind-generators (Golding, Electrical Research Association), costs and scope of three ratings are given, viz. up to 10 kW, from 10 to 100 kW and above 100 kW. For the smallest with battery the minimum figure would probably be about 5·76d/kWh. In the medium size without battery it would be 1·4d/kWh; with diesel stand-by, the wind-plant would be economic as a fuel saver when average wind speeds were from 9 to 18 m.p.h. The largest rated machines, 3,000 to 4,000 kW, would cost about £50/kW and could be competitive with steam plant at average wind speeds above 18 m.p.h. when connected to a main power network. British wind survey methods, types and generators and design and construction factors are discussed. A cost of £70/kW (Duquennois) would be considered satisfactory for supplementing hydro-electric energy in Algeria.

While direct use of solar energy is not regarded as commercially practicable at present, it is suggested that it will probably be used within the present century on a large scale for small isolated plants in many parts of the world where fuel is expensive (Lof, U.S.A.). Costs of collection of sun's heat with different types of collector are worked out in detail. Further studies from France,

Germany, Algeria and Brazil are presented in other papers. The first use of the thermal energy of the ocean at the French 7 MW station now under construction near Abijan (Africa) is discussed, with particular reference to its suitability for Brazil (Casal). While it is theoretically possible to derive electricity from the atmosphere, no technique for utilizing it seems likely to be devised in the near future on any appreciable scale (Holzer and Schilling, Brazil).

A group of papers relating to the co-ordination of the planning of the electric power industry in relation to other economic activities included a comprehensive survey of electric services in Brazil (Berenhauser and Pereira). This indicates the progress made since 1883 up to the end of 1953 with the aid of numerous tables of statistics. It analyses the use of electricity by principal industries and domestic consumers and describes the expansion programme for 1953–1957 which is required to reverse a progressive decline in annual rates of plant installation in earlier years. This year 735 MW of new generating plant is scheduled to go into service, which is 35 per cent of the total installed capacity at the end of 1953.

An account is given of the steps being taken by the Federal Government of Brazil to provide financial resources for supplementing the construction programmes of power companies and public bodies in order to relieve the present power shortage. The particular case of the Minas Geraes area is dealt with in a separate communication (Lopes). Particulars of the consumption of energy in Brazil (reduced to equivalent kWh) of all kinds and from all sources are presented in a second paper (Oliveira) and a method of forecasting demand based on expected growth of population, national income, saving, consumption and investment, as developed for Sao Paulo State.

Plans for electrical development, mainly by hydraulic plants, in Chile are set out in two papers. One relates to generation and transmission in three stages (Ritterhausen and Santa Maria): viz., regional systems; their interconnection to transmit large blocks between them, the direction depending upon the season of the year; integral use of varying characteristics of rivers and lakes. The second deals with the formation and financing of rural electrification co-operatives (Crevas and Mardones).

The principles of long-term planning are stated in a U.S. contribution (Davidson and Meloin), which advocates looking ahead for twenty years and taking an optimistic view of load growth. A five years' forecast of Japanese developments (Yoshrika) provides information on the expected consumption by industries and the power production necessary to meet the growing demand.

Employment in 1953

THE annual report of the Ministry of Labour and National Service for 1953 (H.M. Stationery Office, 5s) states that the year was a good one for employment, the total working population at November, 1953, being about 23½ million, the highest level ever recorded in peacetime.

Dealing with the man-power position in various branches, the report says that in the shipbuilding, engineering, electrical and vehicle building industries labour demands for defence equipment, exports and power station projects were satisfactorily met. The shortage of draughtsmen which had persisted for some years eased.

The estimated labour force engaged in the engineering, electrical goods and vehicles group at the end of 1953 was 2,896,000, of which 572,000 were females, as compared with 2,835,000 (556,000 females) in 1952. While the numbers employed in a few engineering trades, including telegraph and telephone apparatus, electric wires and cables, machine tools and engineers' small tools, showed some decline, those employed on the manufacture of radio apparatus and gramophones rose by 16,000 and there were also increases in some other electrical manufactures. The number of operatives employed in the electrical wiring and contracting industry was slightly higher than in 1952 and employment was maintained at a high level. The average number of unemployed did not exceed 1·5 per cent of the total labour force.

About 13,000 building workers were engaged during the year on the construction and extension of power stations. The number of workers on contracts for the North of Scotland Hydro-Electric Board at the end of the year totalled 5,660, as compared with 3,837 at the end of 1952.

The Technical Personnel Committee, under the chairmanship of Sir George Cater, continued to keep under review the demand for scientists and engineers, both at home and overseas. Progress was made towards meeting an acute need in the electronics industry for specialists in electronic valve engineering. The University Grants Committee and the industry co-operated to enable a post-graduate course in the subject to be started at the Imperial College of Science & Technology in the autumn of 1953.

In a note on the Technical and Scientific Register the report shows that the demand for most classes of qualified scientists and engineers was much in excess of supply although the shortage was less intense than in 1952, probably on account of the slowing-down of the defence programme.

Recruitment to industry is dealt with and it is stated that in the engineering, shipbuilding and electrical goods industries there was an increase of 5,000 in the number of boys under 18.

Other matters dealt with in the report include training for employment and supervision; the resettlement of disabled persons; safety, health and welfare; and industrial relations.

Electrical Retail Trade

THERE is now available from H.M. Stationery Office (£1 2s 6d) Volume II (Retail and Service Trades: General Tables) of the statistics gathered under the Census of Distribution and Other Services, 1950.

These tables analyse and group in various ways the figures obtained from all classes of retail establishments to a total of 531,000. These included, under the " hardware " group, the following electrical establishments:—Radio, electrical goods; radio, electrical goods with repairs; electrical goods with contracting; and electricity showrooms. In the accompanying table we have extracted some of the salient information contained in the various tables. In addition to these there are particulars of radio, electrical goods, " control offices and warehouses " numbering 31 with 1,228 employees and sales of £242,000; those were bulk sales, not to the general public.

It is noted that as electrical contracting was outside the scope of the Census of Distribution there are qualifications in the figures relating to " electrical goods with contracting."

Under " radio, electrical goods," details supplied by 62 co-operative societies are included. These had 264 employees and sales in 1950 of £928,000.

The figures are dissected to show regional distribution; co-operative societies and other organizations; numbers in various annual turnover groups; sales in specified commodity groups; establishments selling goods on hire-purchase or credit instalments; sales per person engaged; gross margin as a percentage of sales; wages as a percentage of sales, etc.

Electrical Retail Establishments, 1950

	No. of establishments	Sales £ thousands	Persons engaged	Wages and salaries, 1950 £ thousands
Radio, electrical goods	5,774	57,865	24,816	5,625
Radio, electrical goods with repairs	2,366	11,926	8,635	1,482
Electrical goods with contracting	1,206	11,775	10,061	2,240
Electricity showrooms	1,107	15,963	5,403	939
Total	10,453	97,529	48,915	10,286

NEW BOOKS

Mathematics in Action. By O. G. Sutton, C.B.E., D.Sc., F.R.S. Pp. 226; figs. 53. G. Bell & Sons, Ltd., 6, Portugal Street, London, W.C.2. Price 16s.

The author admits in his preface that the topics which he has selected are from subjects on which he has professionally worked; hence, he explains the apparently random selection of ballistics, wave theory, flight, statistics and the weather. This, then, is a book for the layman of odd interests. In the first chapter there is a little mathematical philosophizing, then a chapter of 48 pages prepares the reader with differential calculus, integration, partial differential equations and the $(del)^2$ groups for the fray.

Ballistics is dealt with at first, *in vacuo*, i.e., considering only the effect of gravitation, then a discussion on the effect of speed on air resistance gives a method of numerical computation and experimental techniques.

Wave theory involves Fourier analysis, and here a serious error in a diagram (Fig. 24, p. 102) may give much trouble to the layman. It shows a triangular wave (all odd component harmonics) with the analysis showing a *second* harmonic (i.e., double frequency) labelled $y = \frac{4Ka}{9\pi^2} \cos \frac{3\pi x}{a}$; instead of the third harmonic obviously intended. This may be a case of the old error in confusing the engineering nomenclature of 3rd harmonic as 3 times the frequency, as against the musical terminology of this as a second harmonic, but this does not excuse the error.

Radio signals, reproduction, Eigen-functions, etc., follow on in rapid sequence. Flight introduces flow plotting and conformal transformation with aerofoil design, etc. Statistics give an essay on the weighing of evidence, sampling, etc., and a final chapter on meteorology goes to prove how lucky we are to have a forecast, even though it may prove incorrect.

As a piece of light reading, and missing out all mathematics, this book may appeal to the layman. To the serious student this book is too sketchy, even in those subjects which it covers.—E.H.S.

Raw Materials for Electric Cables. By A. King and V. H. Wentworth, B.Sc., A.R.I.C., A.R.Ae.S., F.I.R.I. Pp. 362; figs. 128. Ernest Benn, Ltd., Bouverie House, Fleet Street, London, E.C.4. Price 42s.

In 1948, according to the Monopolies Report on the British cable making industry, the total value of cable supplied by the makers amounted to about £77 million, of which £25 million represented export business. For home business about £17 million was mains cables for all voltages, and rubber and thermoplastic cables were valued at about £18¼ million. This vast capital investment in electric cables and their associated accessories was only made possible by the assurance of a high and consistent technical level in the industry.

The book under review provides a broad but detailed survey of the large number of basic materials used in many forms by cable makers and every effort has been made to make it comprehensive.

Throughout the volume numerous extracts from and references to British Standards are given and a short summary of all these standards could usefully be added at the end of the book. A very limited number of references and articles are quoted and this information should be extended to introduce the interested reader to the many specialized papers available on specific materials.

References are made to resistance and temperature coefficients of standard annealed copper at 60 deg F, but all British Standards for cables recently issued and under revision now relate resistance values to 20 deg C. Reference is also made to single-core high voltage cable with a radial wall thickness of insulation approaching 1in; this statement would be clearer by stating that 275 kV cables have the insulation thickness quoted.

The use of low viscosity oils for oil-filled cable is a British technical development of interest, which is dismissed briefly. Furthermore, one of the authors has been closely associated with the use of micro-crystalline wax for power cables and this development is inadequately described by short general statements.

A vague criticism of type test specifications is given and a more objective and critical approach should be made to this important issue. Comparative test data for paper and v.c. insulated cables would be a useful addition.

The authors have missed an opportunity to discuss critically the large amount of rubber normally used in v.r. cable dielectrics and the effect of this practice in relation to rubber mixes used for the continuous vulcanizing (insulating) technique.

It is stated that for ordinary domestic and industrial wiring the use of polythene seems to be a case of "painting the lily"; nevertheless many hundreds of miles of polythene insulated p.v.c. sheathed cables have been used for wiring purposes with a good service record and with economic advantage. Until recent years lead was the only material used extensively for sheathing cables but British manufacturing developments, arising out of earlier German investigations, have resulted in an extending use of aluminium for this purpose. Chapter 13 reviews this important change in detail.

This book summarizes a wide field of technical data, and the authors have the very real advantage of extensive experience in one of the world's largest cable making companies. It can therefore be strongly recommended as an excellent publication of outstanding merit.—C.C.B.

Basic Principles in Electrical Engineering. By I. H. Child, B.Sc.(Eng.), A.M.I.E.E. Pp. 112; figs. 45. E. & F. N. Spon, Ltd., 15, Bedford Street, London, W.C.2. Price 10s. 6d.

This book is a collection of articles on basic principles, misconceptions, etc. The subjects include transformers, rotating field theory, alternator load sharing and short circuit phenomena, system short circuit calculations, single-phase induction motors, rotary convertor synchronization, Ward-Leonard control, circuit breaker theory and smoothing circuits for valve rectifiers.

It will be seen from these subjects that the range is so wide as to admit little serious discourse on any one, but at times the treatment is excellent. Possibly the main criticism is in the fact that the writing of articles and of books involves two entirely different techniques. However, the treatment is as a whole sound, though the loose statement in the single-phase induction motor theory, "The resultant of these two torque slip curves . . . is seen to be a sine wave . . ." is obviously a mistake and should have read "is seen to be *similar* to a sine wave," the actual equation being

$$T \propto \frac{S}{R^2 + (SX)^2} - \frac{2 - S}{R^2 + (2 - S)^2 X^2}$$

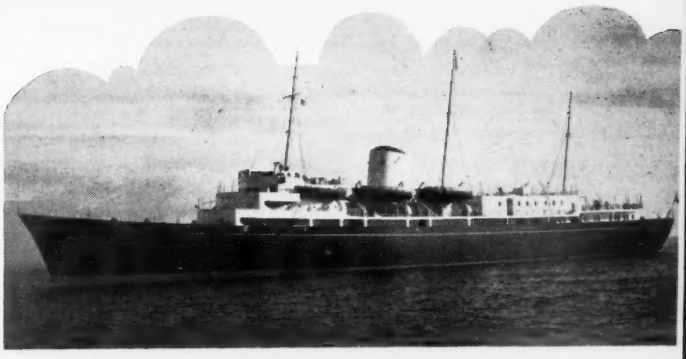
which is hardly the equation of a sine wave.

The use of the B.S.205 definition of synchronous impedance as the ratios of field currents for open circuit rated e.m.f. and short circuit rated current may be misleading, as it contradicts so many standard textbooks. This book should not, however, be neglected, for it presents some useful bridges over old pitfalls.—E.H.S.

THE ROYAL YACHT

Britannia

SOME DETAILS OF THE ELECTRICAL INSTALLATION



It is now possible for us to publish this brief description of the Royal Yacht *Britannia* which was launched by H.M. The Queen at the Clydebank shipyard of John Brown & Co. (Clydebank), Ltd., last year and which saw service earlier this year in the final stages of the world tour of the Queen and the Duke of Edinburgh.

The yacht had its origin in the decision of the Admiralty in 1951 to put into the naval construction programme a hospital ship which would be used in peace-time by the late King George VI as a replacement for his yacht *Victoria & Albert*, which was by then completely useless as a seagoing vessel.

The overall length of the *Britannia* is 412ft and the vessel's maximum breadth is 55ft. Her light displacement, i.e., without fuel, water or stores, is 3,990 tons, while her load displacement with 330 tons of fuel and 120 tons of fresh water is 4,715 tons. Her gross tonnage, as measured just before completion, is 5,769 tons. The main propelling machinery develops 12,000 s.h.p. which on trials gave a speed of $22\frac{3}{4}$ knots. Thus the requirement of a continuous sea-going speed of 21 knots can be met. Her endurance with 330 tons of fuel oil is 2,100 miles at 20 knots, or 2,400 miles at the economic speed of 15 knots. Extra tank capacity is provided for long ocean voyages, and by its use the fuel capacity can be increased to 490 tons and the capacity for fresh water to 195 tons. To enable the ship to make exceptionally long ocean passages, a standard naval light jackstay rig is provided by which fuel can be transferred at sea from an attendant vessel at a rate of 250 tons per hour. Accommodation for the royal party, or alternatively for a hospital, has been provided in the after part of the ship, whilst that for the ship's officers and crew is forward. Working spaces such as the galleys and laundry have been grouped amidships over the main machinery spaces so that exhaust ventilation can be led up inside the funnel.

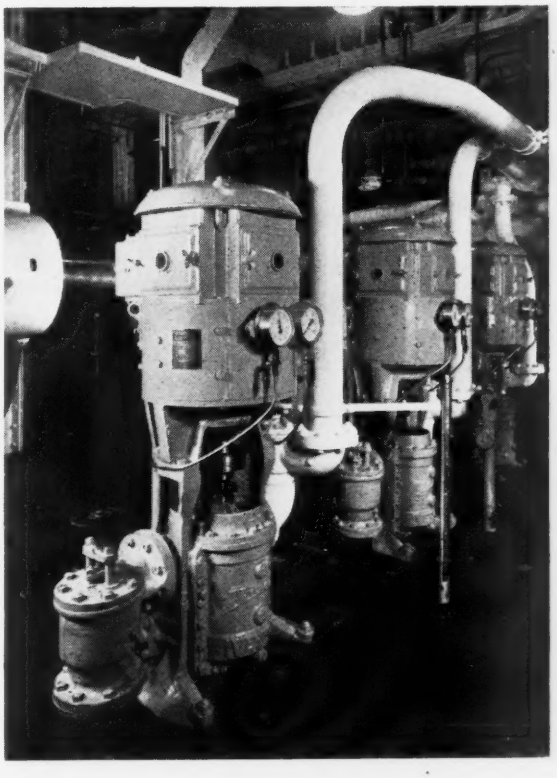
Generating Plant

With regard to the general electrical installation we do not think we can do better than quote from a paper " Her Majesty's Yacht *Britannia* " which was presented to the Institution of Naval Architects earlier this year by Sir Victor Shepheard, K.C.B., R.C.N.C., director of naval construction, Admiralty.

When considering the generator requirements it was decided that : (*a*) When the royal party was on board or the ship was in use as a hospital ship it would be necessary to have steam on the main boilers and the steam turbo-generators would carry the electrical load. For harbour use at other times a diesel generator would be installed to cover the harbour load; (*b*) the diesel generator would not be used at sea because of noise and vibration; (*c*) the generator capacity provided must be capable of meeting the requirements with adequate stand-by power; (*d*) the emergency dynamo required by M.O.T. regulations must be regarded as a completely separate item to the above commitments. The dynamo load at sea was estimated to be approximately 730 kW and the harbour diesel load about 250 kW. The following generators are fitted in the *Britannia* for lighting and power supplies: three 500 kW steam turbo-generators; one 270 kW diesel generator; and one 60 kW emergency diesel generator.

Consideration was given to fitting an a.c. installation in accordance with recent Admiralty policy for H.M. ships, but once again the time factor precluded the possibility of obtaining delivery of new generators in time to avoid delay in completion of the ship. Furthermore, most of the main machinery auxiliaries were planned for electrical drive; the economic operation of these auxiliaries, including boiler-room fans, depended upon the availability of a speed

All the motors are of special marine design with drip-proof enclosures; representative installation of auxiliary pumps



control range not obtainable with standard type a.c. motors. Considerable difficulty would also have been experienced in obtaining delivery of d.c. turbo-generators in time to meet the completion date of the ship, and it was therefore fortunate that three 500 kW d.c. machines were available and not otherwise required. These machines were not compounded, however, and it was necessary for this to be done, and further modifications made to meet Lloyd's requirements, before the generators could be installed.

D.C. Installation

The ship's d.c. installation is at a constant voltage of 225, all permanent wiring being on the two wire, two conductor system with both poles insulated. The three turbo-generators are fitted in the generator room and any two are capable of supplying the full sea-going load. The 270 kW diesel, also fitted in the generator room, is capable of meeting the harbour load or the salvage load when steam is not available. To allow for maintenance of this diesel generator in harbour when necessary, steam can be supplied from the auxiliary boiler to run one of the turbo-generators to cover the harbour load. The generators feed into a main switchboard in the generator room. Distribution from the main switchboard to the various circuits is by double pole circuit breaker, switches and fuses following normal practice.

The emergency diesel generator, together with its own starting battery, is situated in a shelter deck compartment to meet M.O.T. requirements. It feeds into a switchboard fitted adjacent to the generator and in an emergency will supply vital services such as radio, salvage pumps, emergency lighting and the power operated watertight doors. A.c. services are supplied by two d.c./a.c. motor generators having outputs of 35 kVA, 230 V, 50 c/s, single phase. An a.c. switchboard is fitted with two control panels to distribute the power required for radio, sound reproduction equipment, X-ray, cinema and echo sounding. Two 220/24 V d.c./a.c. motor generators with control gear, a 24 V secondary battery and a switchboard are fitted in the low-power room for supplying the gyro compass equipment, log, telephones, gongs, alarm bells, etc. A permanent system of degaussing is fitted and is fed from the 225 V system.

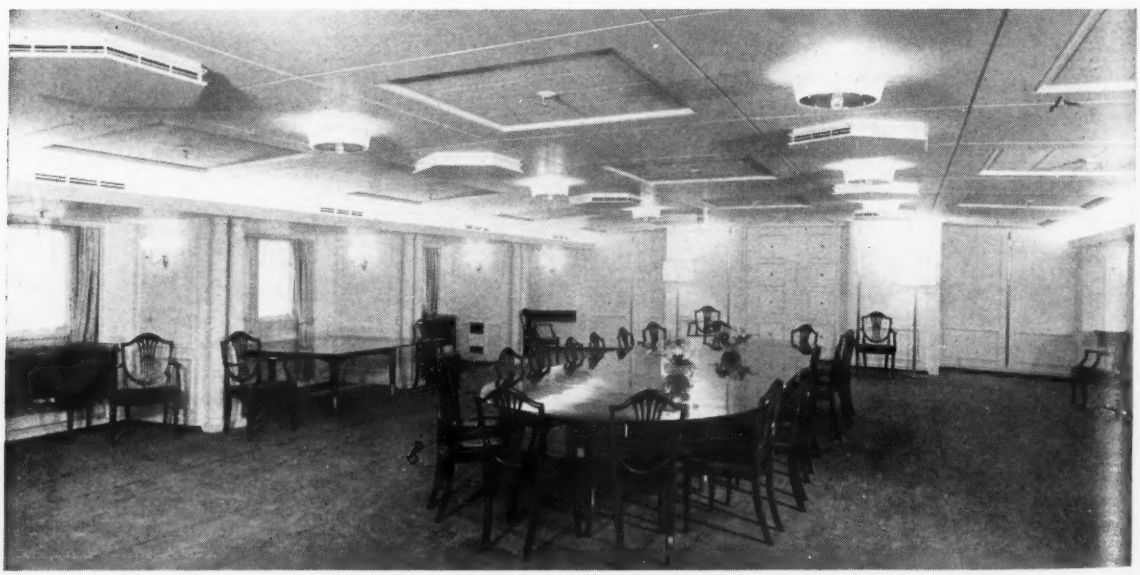
Three 500 kW self-contained auxiliary turbo-generators which form the main generating plant were supplied by the Metropolitan-Vickers Electrical Co. Each set has a single-cylinder condensing turbine, which drives, through a solid coupling and flexible quill-shaft, the pinion of a double-helical single-reduction gear; this, in turn, drives a d.c. generator. The turbine, which runs at a speed of 6,500 r.p.m., incorporates certain special refinements, notably nickel leaded-bronze gland segments and stabilized bearings giving smoother running and reducing vibration. The condenser shell, which is integral with the lower half of the turbine exhaust, is arranged with the tubes parallel to the centre line of the set: this reduces the space required for tube withdrawal, which can be carried out, if necessary, below the generator. The condensing plant is provided with a steam operated two-stage air ejector and mechanically driven circulating-water and extraction pumps. The d.c. generator is a level compounded machine, totally enclosed and water-cooled, and runs at 1,000 r.p.m. It is continuously rated at 500 kW at 225 V. The permissible overload capacity is 10 per cent for two hours.

Marine Motors

We have a lengthy list of motors by Laurence, Scott & Electromotors, Ltd., which are installed in the yacht, driving all manner of pumps by Drysdale, G. & J. Weir and Stothert & Pitt; f.d. and i.d. fans by James Howden; ventilating fans by Thermotank; and other motors driving capstans, steering and turning gear, etc. All these motors are of special marine design which, in the case of the larger units, means that provision is made for dismantling in confined spaces, in addition to numerous modifications in respect of insulation, materials, terminal box design, etc. The majority of the motors have drip-proof enclosures, but the draught fan motors are of the pipe ventilated type. Deck machines, such as the boat davit motors, are deck watertight. Most of the pump motors are vertical machines mounted on top of the pumps and, of course, these have ball and roller bearings. The draught fan, steering gear and ventilating fan motors have sleeve bearings to secure quiet running.

Certain of the lighting fittings throughout the yacht are special designs produced in collaboration with the decorative architects responsible for the interior decoration

The dining room lighting is among the outstanding electrical features of the yacht



" Perspex "-enclosed fluorescent lighting fittings are widely used

of the ship. The following notes relate to fittings supplied by the General Electric Co., Ltd. An appropriate theme has been combined with elegance in a circular ceiling fitting for the dining room and upper deck entrance, in which a sparkling " coronet " effect is given by cut glass prisms encircling the lamp. A faceted glass ball is mounted at the centre of the circular gold bronze plate which forms the underside of the fitting. The prisms are attached to the framework at top and bottom by chromium-plated screws. In addition to the light transmitted through the prisms, some is reflected from the ceiling. The ten fittings of this type in the dining room are 16in in diameter and each takes a 100 W lamp. Ten similar fittings, 12½in in diameter, with 75 W lamps, light the upper deck entrance.

Additional lighting in the dining room is provided by ten decorative two-light brackets with matt gold bronze metalwork, reflecting Flemish influence in the design of the backplate and interlaced stems, the same style being widely adopted throughout the ship; and by hot cathode fluorescent cornice lighting.

For the cornice lighting a channel fitting specially designed for marine installation has been used in which the lamps are offset from the centre of the channel and project beyond it. Another style of ceiling fitting installed in considerable numbers has a circular flashed opal disc set in a ring of matt gold bronze metal. A " sunburst " design in brilliant cut glass appears at the centre of the dish.

Floor standards in the dining room, drawing room, and anteroom have fluted stems of matt gold bronze, and grey marble bases with a petal motif in silver bronze at the centre.

Special provision has been made for entrance and stairway lighting in certain parts of the ship. In the main deck entrance four enclosed fittings with matt bronze metalwork and flashed opal glazing, each with two 60 W lamps, are mounted at the junction of bulkhead and ceiling. To give a spotlighting effect on the stairway from the shelter deck entrance, " Gecoray " reflectors are mounted above the ceiling over louvre frames.

An unusual design of adjustable bracket has been supplied for a sitting room and the sun lounge, consisting of a simple spun reflector for a 60 W or 100 W lamp attached by a universal joint to a horizontal tubular stem.

Numbers of Roanoid and standard G.E.C. deckhead, bracket and writing table fittings have also been supplied. For lighting the special observation lounge forward in the ship a standard ceiling fitting was chosen by the builders. Five of these have been installed. They are a circular design, for three 60 W lamps, with real bronze metalwork and a deep white glass bowl.

Over 350 " Perspex "-enclosed fluorescent fittings have been supplied by the British Thomson-Houston Co., Ltd., for use on the yacht. These fittings house twin 2ft, 20 W fluorescent lamps and incorporate special starting relays.

The telephone switchboard is designed for cordless operation. Calls and operating sequences are signalled to the operator by lamps, and connections are made by key switches. The board, which was constructed by the General Electric Co., Ltd., accommodates 94 ship's extension lines and has provision for six shore lines. Connections through the ship's telephone exchange can be made from any extension line in the ship to any type of shore telephone exchange. Selected telephone lines may be connected directly through to shore exchange when the ship's exchange is unattended.

Change-Over Contactors

THE British Standards Institution has recently issued a revised edition of the seventeen year old B.S. 764, " Automatic change-over contactors for emergency lighting systems." The contactors dealt with are those intended for use in circuits feeding safety lights which enable the lighting circuits to be automatically switched between the normal source of supply and an alternative source when the normal source is interrupted, and reconnected when normal conditions are restored.

In addition to specifying a range of standard current ratings, the performance and certain constructional details of double-pole change-over contactors for use on low voltages are specified. To meet the demand for reliable automatic change-over contactors smaller than those built to comply with the 1937 edition of the Standard, a 15 A 30 V size has been introduced and specific design requirements for this size are given.

In the revision it has been possible to specify the requirements of contact pressure and the temperature rise of operating coils with greater precision; also to take into account the increased use of silver in contact manufacture and the development of certain forms of contact not covered by the 1937 edition.

The current Cinematograph Regulations require that automatic change-over contactors in cinemas shall comply with B.S. 764, and it is understood that a revised edition of these Regulations will be issued shortly. To enable new designs to be produced which will comply with the revised standard it will not be deemed to be fully applicable until six months after the issue of the revised Cinematograph Regulations.

The use of the registered certification mark of the B.S.I., as evidence of compliance with the specification, is required.

Copies of the Standard can be obtained on application to the British Standards Institution, 2, Park Street, London, W.1, price 4s.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted or the opinions expressed by correspondents.

Variations in Industrial Tariffs

YOUR leading article in the 2nd July issue, with regard to benefits to be obtained from power factor correction, has prompted me to point out the variations which exist in this regard, following the introduction of standard industrial tariffs by several Electricity Boards. Variations from area to area, covered by different Electricity Boards, mean in effect that consumers in one Board's area will be obliged to provide capital for the installation of power factor correction equipment under certain conditions, whereas identical conditions in another Board's area would not require this capital outlay.

In the past, during discussions with officials of the various Electricity Boards, I have attempted to obtain some logical reason for these variations, but have not as yet been convinced that they are necessary or just. When bearing in mind that all Electricity Boards purchase supplies from the Central Authority on the same terms, the position becomes even more confusing.

The following is a summary of the position, with regard to the ten Electricity Boards which have up to the present time issued standard industrial tariffs. Where an annual m.d. tariff is available the effect of the power factor clause in respect of this type of tariff has been taken for the purpose of this comparison; where not available, the monthly or quarterly m.d. tariff has been taken.

Electricity Board	Period for m.d. charge	Circumstances in which financial penalty (in respect of application of power factor clause) is incurred
South West Scotland	Monthly	Any average lagging p.f. value below unity (on m.d. charge only)
South East Scotland	Annual	Any lagging or leading p.f. value below unity at the time of m.d. (on m.d. and kWh charges)
North Western	Monthly (or quarterly)	Any average lagging or leading p.f. value below 0·9 (on m.d. charge only)
Merseyside & North Wales	Annual	Any lagging or leading p.f. value below 0·928 (on m.d. charge only). Highest kVAr m.d. against kW m.d. recorded in period is basis of calculation
Yorkshire	Annual	Any lagging or leading p.f. value below unity at time of m.d. (on m.d. and kWh charges)
East Midlands	Annual	Any lagging or leading p.f. value below unity at time of m.d. (on m.d. charge only)
Midlands	Monthly	Any lagging or leading p.f. value below unity at time of m.d. (on m.d. charge and also on kWh charge where load factor exceeds 51 per cent)
Eastern	Monthly	Any lagging or leading p.f. value below unity at time of m.d. either: 1. Where demand does not exceed 75 kVA—on fixed charge and kWh charge, or 2. Where demand exceeds 75 kVA—on fixed charge, m.d. charge and kWh charge
South Western	Annual	Any average lagging p.f. value below 0·9 (on m.d. charge only). Further small financial penalty on maximum service capacity charge incurred for any lagging or leading p.f. value other than unity at time of m.d.
South Wales	Annual	Any average lagging or leading p.f. value below 0·85 (on m.d. charge only)

The publication of this letter may prompt one of your readers to offer some logical explanation of these variations.

Harmondsworth, Middx. J. E. HERBERT.

Arc Control Devices

I SHOULD like, if I may, to congratulate Messrs. McNeill and Crane on their very interesting and valuable article on "Arc Control Devices" in your recent issues[1], and to comment on one or two points in it. In the first place, the E.R.A. tests described in Report Ref. G/XT31[2] and for which, among others, the pressures were calculated in Report Ref. G/XT72[3], reached powers very little less than those in the authors' recent tests. The maximum power reached was 20 kA at 22 kV, and the rupturing capacity of the breaker estimated from the tests was 800 MVA[2].

We were therefore able to calculate with some confidence pressures to be expected in some of Mr. McNeill's early tests, and these calculations emphasized a point of considerable interest, namely, that the arc voltage is itself a pressure recorder. For, though no pressure recorder had been in use in the tests referred to, the arc voltages derived from the relation $e_1 = 50\sqrt{p}$, using the calculated values of p, were close to the observed values.

Regarding the discrepancy between calculated and observed values at low currents in Table 2, this did not appear in our investigation. A series of eight tests at currents between 3·5 and 5 kA gave pressures between 0 and 100 lb/sq in, in fair accord with the calculated values. Part of the discrepancy in the authors' results may be due to the use of equations (3) and (4), in which the assumption is made that the gas flows out with velocity v_T throughout the test. This is only true, as the authors state, when the pressure inside the pot is more than about twice the pressure outside. Below this pressure some such expression as $v = v_T\sqrt{(p - 1)}$ should be used for the velocity and the calculation made stepwise from the expression (1) for dp/dt, using small increments of time[3,4]. However, there would appear to be a real discrepancy between the pressures recorded at low currents in the two investigations.

A re-evaluation of the parameters involved under different conditions is at present under way, and several of our member firms have very kindly let us have their test records to assist us in this work. The results of the investigations of Messrs. McNeill and Crane will also form a very useful contribution to this re-assessment.

Perivale, Middlesex. CHAS. E. R. BRUCE, M.A., D.SC., M.I.E.E.
Electrical Research Association.

REFERENCES

[1] "Arc Control Devices," W. A. McNeill and P. H. G. Crane, *Electrical Review*, 9th and 16th July, 1954, 155, 43–48 and 89–92.

[2] E.R.A. Report Ref. G/XT31, "High Power Tests on E.R.A. Baffle Device at Hebburn, May, 1931." W. B. Whitney, C. E. R. Bruce, A. E. Helden and L. Gosland. 1931. (Report available to E.R.A. members.)

[3] E.R.A. Report Ref. G/XT72, "The Calculation of the Pressures set up inside the Cavity of an E.R.A. Side-Blast Baffle Circuit Breaker," C. E. R. Bruce, 1938.

[4] "Circuit Breaking. Researches by the British Electrical and Allied Industries Research Association" (Ed. H. Trencham), London: Butterworth, 1953, p. 137.

A copy of Dr. Bruce's letter was sent to Mr. W. A. McNeill, who replies as follows:—

Manufacturers of oil-circuit breakers have been greatly assisted by the fundamental work carried out by the Electrical Research Association and the intention of our article was to illustrate the application to commercial forms of switchgear. The discrepancy between calculated and observed values at low currents may possibly be due to the cause suggested by Dr. Bruce, although an attempt was made to allow for the effect of differential pressures. The comparison of data obtained on different types and makes of circuit breaker, as now undertaken by the Electrical Research Association, will help to establish whether the parameters used are universally applicable. In the meantime, however, the authors are satisfied that very valuable use can be made of the E.R.A. methods of calculation.

VIEWS on the NEWS

By REFLECTOR

THERE were reports last week of an attempt by the Electrical Trades Union to prevent the wife of a member of the Union from selling Lyons' ice-cream from a stall which she operates. This was merely a further foolish item in the Union's campaign against J. Lyons & Co. because of their refusal to dismiss a supervisor who declines to rejoin the Union. Signs of sanity are appearing, however. Electricians employed by the British Overseas Airways Corporation, who refused to maintain frozen food containers because they were used for Lyons' products, decided to remove their ban last week. According to a report in *The Times*, a union representative said that the ban was "too complicated to operate." I said something of the sort three weeks ago when I pointed out that there were limitless possibilities in the pursuit of a policy of this kind.

* * *

A *Sunday Express* report says that the strike had repercussions on a "barbecue" organized by Lyons at Olympia last Saturday. Because an electrically-operated spit could not be used for roasting an ox seven men had to turn a manually-operated spit for fifteen hours (working in shifts presumably). As an emergency measure batteries were installed for the operation of amplifiers, footlights, bells, etc., but apparently the hundreds of candles provided were not needed. And so it goes on!

* * *

In last week's *Electrical Review* Mr. A. M. F. Palmer, M.P., mentioned Lord Hinchingbrooke's consternation at the fact that the B.E.A.'s advertisements were growing bigger and bigger. Actually it would seem from his other remarks that what he had in mind was the current series of E.D.A. advertisements—very effective ones. Why should his Lordship be perturbed by this? Although it is nationalized, the electricity supply industry is still a commercial concern and has to pay its way. Therefore it adopts commercial methods of which advertising is one. Why should it be considered reprehensible to publicize electricity and quite in order to advertise margarine, detergents and petrol, for example?

* * *

When the Minister of Fuel and Power announced recently that the Marchwood (Southampton) power station of the B.E.A. would be equipped to burn both oil and coal he said that the price agreed with the Esso Petroleum Co. would make the cost of using oil the same as if coal were used. With the current price of heavy fuel oil at over £9 a ton, there has been speculation about the price the B.E.A. has agreed to pay. The subject is discussed in last week's *Economist* at some length. Upon the basis that the price of coal at Southampton in 1956 (when the station is scheduled to go into partial operation) will be £4 a ton, the *Economist* estimates that oil will have to be supplied at £6 a ton to fulfil the Minister's prophecy. The course of oil prices in the next few years is uncertain but it seems that the tendency is against any remarkable decrease in the price of fuel oil. Referring to the possible employment of dual-firing in a number of other stations, the *Economist* considers that "Marchwood cannot be taken as proving that the price of oil, on a large scale and in the long run, will be right for B.E.A." Dual-firing can best be considered as a costly insurance premium against failure of the coal industry to supply all of the extra 14 million tons which will be needed by 1960.

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* * *

Facsimile telegraphy goes back to before 1867. In that year, records the *Electrical Review* of 1st August, 1874, the Abbot Caselli showed his apparatus at the Universal French Exhibition. This was almost immediately superseded by a system evolved by Meyer. In this a message written in insulating ink on a metallic paper was wrapped round a 10 cm diameter drum revolved by clockwork at 75 r.p.m. The paper was traversed by a stylus and impulses were transmitted to a synchronized receiver by which the signals were reproduced. It is clear that the success of the apparatus depended on the mechanism by which the movements at the sending and receiving stations were controlled. The report said :—

> "The regularity . . . is obtained by the use of a conic pendulum, which is a stem supporting a ball of a certain weight. When two pendulums thus constructed are set in motion to the same pitch, they describe sensible isochronous amplitudes, maintaining the concordance of the two apparatus for several minutes—a time sufficient to traverse the whole of the cylinder."

PERSONAL AND SOCIAL

News of Men and Women of the Industry

THE English Electric Co., Ltd., announces that the activities of the Domestic Appliance Division and the Television Sales Department are to be combined. **Mr. H. C. Timewell,** who has headed the company's Domestic Appliance Division for the last three years, will be manager of the new Domestic Appliance and Television Division. Under the new arrangements, Mr. A. M. Parkinson's responsibilities as home and export sales manager will be expanded to include television in addition to domestic appliances. The domestic appliance and television sales representatives will continue to cover their present territories. These changes are made following the resignation from the company of **Mr. D. C. Spink.**

Mr. G. H. Gillam, A.M.I.E.E., has been appointed chief engineer of Taylor, Tunnicliff & Co., Ltd., to succeed the present chief electrical engineer, Mr. E. D. Spencer, A.M.I.E.E., who has retired after thirty years with the company. Mr. Gillam received his early training at the Rothervale Collieries and By-Products Plants of the United Steel Company and with the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park. In 1929 he joined Taylor, Tunnicliff & Co., Ltd., as technical assistant and in 1934 transferred to the firm's London office as engineering assistant to the London director, Mr. M. J. Dark. Mr. Gillam serves on many British Standards Institution and Electrical Research Association Committees and is chairman of Group 25 (Insulators) and of the Insulator Study Committee of C.I.G.R.E. He also served on the Supply Section Committee of the Institution of Electrical Engineers from October, 1947, to 1950. He will take up his appointment at the company's head office in Stoke-on-Trent immediately after his return from the International Electro-Technical Commission meetings in Philadelphia, about 19th September.

Mr. G. H. Gillam

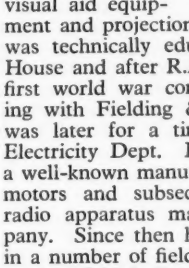
Mr. James C. Macfarlane, O.B.E., Wh.Sc., M.I.E.E., who has been chairman and managing director of the Macfarlane Engineering Co., Ltd., since its inception in 1911, has resigned from the office of managing director, but retains his post as chairman. **Mr. J. W. Macfarlane,** Wh.Sc., Ph.D., M.I.E.E., J.P., becomes managing director and **Mr. C. C. Macfarlane,** M.I.E.S., M.I.W., becomes an additional director. **Mr. A. W. Muir** is appointed secretary of the company. **Mr. W. I. Macfarlane,** Wh.Sc., B.Sc., A.R.T.C., A.M.I.E.E., remains as a director, and is responsible for electrical design.

Mr. C. E. T. Cridland, A.M.I.E.E., has been elected president of the Scientific Instrument Manufacturers' Association for 1954-55. Mr. Cridland is chairman and managing director of a group of companies including Aldis Bros., Ltd., the makers of the well-known signalling lamp and visual aid equipment and projection instruments. He was technically educated at Faraday House and after R.A.F. service in the first world war completed his training with Fielding & Platt, Ltd., and was later for a time in the Bristol Electricity Dept. He was then with a well-known manufacturer of electric motors and subsequently formed a radio apparatus manufacturing company. Since then he has been active in a number of fields. He has served on the S.I.M.A. Council since 1949.

Mr. C. E. T. Cridland

Fellowship of the Illuminating Engineering Society has been awarded to **Mr. J. B. Collins** of the Building Research Station, Garston, and to **Mr. H. F. Stephenson,** who is with the General Electric Co., Ltd., Research Laboratories, Wembley.

Mr. H. G. Boullen, B.Sc.(Tech.), A.M.I.E.E., branch manager for the Nottingham area of the Lancashire Dynamo group, has been appointed home sales manager of Lancashire Dynamo & Crypto, Ltd. He will take up this new position on 1st September next, and will operate from the London office of the company at St. Stephen's House, Victoria Embankment, London, S.W.1. After receiving his education and technical training at Bowden College, Manchester Grammar School and Manchester University, Mr. Boullen served a works apprenticeship at the Trafford Park works of L.D.C. Subsequently he joined the sales staff and became Nottingham Branch manager in 1929.



Mr. H. G. Boullen

Travelling scholarships for 1954 (value £50) have been awarded by the **Worshipful Company of Tinplate Workers** to the following:—Mr. C. J. Smith, employed by W. T. Henley's Telegraph Works Co., Ltd. (award presented by the Covered Conductors Association); Mr. J. J. Bell and Mr. T. Whitelaw, employed by Yarrow & Co., Ltd. (award presented by the Water Tube Boiler Makers' Association); Mr. A. Islip, International Combustion, Ltd. (presented by the Water Tube Boiler Makers' Association); and Mr. N. Gee and Mr. T. D. Jones, Metropolitan-Vickers Electrical Co., Ltd. (presented by the British Electrical and Allied Manufacturers' Association).

Mr. F. R. Haigh, district engineer with the North Western Electricity Board, leaves this month to take up the position of senior assistant engineer (overhead lines), with the Yorkshire Electricity Board at Scarcroft.

Mr. C. P. Storr, M.A., M.I.Mech.E., M.I.E.E., has been appointed manager of the Metropolitan - Vickers Electrical Export Co.'s Dominions Division. Mr. Storr took his degree at Cambridge and went to Metrovick as a college apprentice in 1928. After working as a relay engineer in the Meter Engineering Department he went to India in 1935, joining the head office of Associated Electrical Industries (India), Ltd., at Calcutta. During the war he was seconded to the Indian Ordnance Service as civilian gazetted officer, in which capacity he was responsible as works manager for the installation and commissioning of the Kanpur ordnance factory. In 1946 he was appointed deputy chief engineer, A.E.I. (India), and he became chief engineer and a director in 1949. In that year he was also made a director of Associated Electrical Industries Mfg. Co., Calcutta. Early in 1953 Mr. Storr rejoined Metrovick as power systems engineer, and he undertook the organization of a department to

Mr. C. P. Storr

investigate power system problems. Mr. Storr has been chairman of the Calcutta Branch of the Institution of Electrical Engineers, and has also been a member of the Electrical Plant and Switchgear Sectional Committee and the Transformer Oil and Lubricants Sub-Committee of the Indian Standards Institution.

Mr. J. Haynes, A.M.I.E.E., A.M.I.Mech.E., A.M.Inst.F., since 1952 power station superintendent at the Derby power station, has been appointed to a similar position at Tilbury. From 1929 to 1938 he was with Wolverhampton Corporation Electricity Department. He then joined the North Eastern Electric Supply Co., as senior assistant engineer, serving at various substations and the Carville and North Tees power stations. From 1941 to 1944 he was control engineer at Woolwich power station and from 1944 to 1951 was shift charge engineer at the Bow, Grove Road and Deptford East power stations, becoming turbine house and electrical superintendent at the last-mentioned station in 1951.

Mr. J. Haynes

In reporting the I.E.E. elections in our last issue we regret that we inadvertently referred to **Mr. H. W. Grimmitt** as deputy chief engineering inspector in the Electricity Division, Ministry of Fuel and Power. Mr. Grimmitt was promoted to chief engineering inspector in September last.

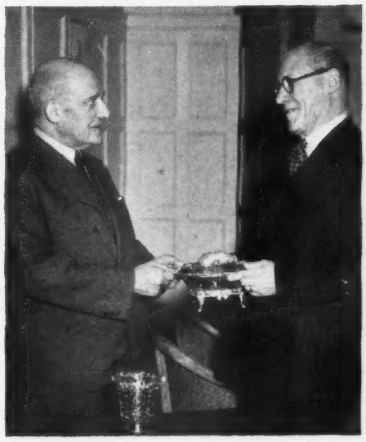
Mr. W. A. Reynolds, M.A., A.M.I.Mech.E., has been appointed deputy general manager of the Witton Moulded Insulation Works of the General Electric Co., Ltd., in succession to **Mr. A. E. Phipps,** whose retirement was recently announced. Born in Bridport, Dorset, in 1919, Mr. Reynolds was educated at Sidcot School, Somerset. Throughout the war he was attached to the Friends Ambulance Unit and served overseas in Burma and China. On his return he entered Emmanuel College, Cambridge, where he graduated, and after serving his apprenticeship with the G.E.C. was appointed a planning engineer. He transferred to the Witton Moulded Insulation Works as assistant to Mr. Phipps in 1951.

Mr. W. A. Reynolds

The Sussex Centre of the **Electrical Industries Benevolent Association** has arranged to hold its annual ball at the Grand Hotel, Brighton, on Friday, 28th January, 1955.

Mr. L. C. W. Turner has been appointed sales director of the Brush Electrical Engineering Co., Ltd. Mr. Turner has been with Crompton Parkinson, Ltd., for the past twenty-two years. He was formerly manager of the Belfast office and later took charge of the north-west area, operating from Manchester. He will take up his duties in Loughborough on 1st September.

Mr. W. H. Williams, who recently retired from the board of the General Electric Co., Ltd., and the position of manager of the Osram Lamp Dept. of the company, was the guest at an informal luncheon held at the Savoy Hotel, London, on 16th July. On behalf of the directors of the company Sir Harry Railing, chairman and joint managing director of the G.E.C., presented Mr. Williams with an antique silver fruit and sugar set.



Sir Harry Railing (left) making the presentation to Mr. W. H. Williams

A fine afternoon favoured the family day and children's sports organized by **W. T. Henley's (Woolwich) Social and Sports Club** at New Eltham last Saturday. A varied programme provided something for everybody in the large gathering of over 1,000 Henley employees and their families. Numerous sideshows and spectacular turns by visiting artistes added to the fun.

OBITUARY

Mr. Clement F. Davies, who died recently at the age of eighty-three, was an assistant to the electrical engineer of the former L.M.S. Railway until his retirement in 1935. Mr. Davies, who was a B.A.(Cantab.) and a senior wrangler, took a prominent part in the electrification of the Euston-Watford Junction suburban line and in the construction of Stonebridge Park power station. In 1930 he was concerned in the electrification of the Manchester South Junction and Altrincham line and other large projects with which he was associated were the Barking-Upminster line electrification, the re-organization of the electricity supply for Crewe Works, and the re-organization of Formby power station.

Sir Herbert Williams.—The death occurred on Sunday at Westminster, at the age of sixty-nine, of Sir Herbert Geraint Williams, Bt., M.Sc., M.Eng., A.M.I.C.E., M.P. for Croydon East. He had collapsed in the House of Commons on the previous Thursday evening. Born at Hooton, Cheshire, Sir Herbert was educated at Liverpool University and after serving an apprenticeship with Siemens Bros. Dynamo Works, Stafford, held positions as marine engineer with Mr. C. A. Smith, consulting engineer, and as electrical engineer with Sir John Norton Griffiths, Bt., on contract work. From 1911 to 1928 he was secretary and manager of the Machine Tool Trades Association. During the 1914-18 war he was secretary of the machine tool department of the Ministry of Munitions and a lieutenant in the Royal Army Ordnance Corps. Afterwards he became executive director of the Incorporated Association of Electric Power Companies. Sir Herbert was Parliamentary Secretary to the Board of Trade from 1928 to 1929 and was a member of the National Committee of the House of Commons on Public Expenditure from 1939 to 1944. He acted as joint secretary of the Engineering and Shipbuilding Hours of Labour Investigation Committee in 1920-22 and was director of the Empire Industries Association in 1926-28. From 1914 to 1916 he was a member of the Wimbledon Borough Council and from 1940 to 1944 an alderman of the London County Council. He was chairman of Bennis Combustion, Ltd., and a director of the Power Plant Co., Ltd., Franco Signs, Ltd., and other companies.

The late Sir Herbert Williams

Mr. P. H. Wilson.—The death occurred on 25th July at the age of sixty-nine of Mr. Percy Hutchinson Wilson, O.B.E., deputy managing director of the Stanton Ironworks Co., Ltd. Mr. Wilson was a past-president of the Institute of British Foundrymen.

Mr. E. C. Givens.—The death occurred in New York on 20th July of Mr. Earl C. Givens, vice-president of the International General Electric Co. (U.S.A.).

WILL

Mr. P. Tonks, joint managing director of the Revo Electric Co., Ltd., who died on 25th March last, left £13,736 gross (£13,180 net).

STOCKS and SHARES

AFTER a fairly sharp reaction in the early part of last week, prices in the industrial market picked up much of the lost ground. Activity, however, contracted noticeably, and it seemed that the holidays were beginning at last to make their normal influence felt in that respect. Electrical equipment shares as a whole benefited from the excellent impression made by the G.E.C. annual results. Gilt-edged stocks were irregular, but a good demand for issues bearing a high rate of interest was reflected in further improvement amongst 4½ per cent British Electricity stocks. The market continues to expect a fresh issue by the Authority before long.

G.E.C. Results

On satisfaction with the increase in the General Electric dividend from a total of 11¼ to 12½ per cent, and with the profits statement, the company's £1 ordinary shares were marked up from 47s 6d to 50s, with bargains recorded 1s higher. This made a gain of some 7s over the month as a whole. Market expectations were fulfilled by the final distribution, and exceeded by the extent of the recovery in earnings. Group profits before tax, in rising from £4·2 to £5·8 million, have gone a long way towards recovering the 1952–53 setback. Net surplus attributable to the parent company, after tax, is almost doubled at a little under £2·4 million, so that the new rate of dividend is covered more than 2½ times by the amount distributable. In advance of the report, which should now be in stockholders' hands, the assumption was that much of the credit for these capital results was due to better returns for those sides of the business concerned with consumer goods.

Price Changes

A.E.I. shares have been dealt in up to nearly £3 (the official quotation being that figure); this establishes another all-time record for them. English Electric, changing hands up to 50s, and B.I.C.C. at 46s 3d, earned a similar distinction. Southern Areas continued on their upward way with another gain of 1s 3d. Improvements of similar amount were recorded also in Aerialite, Ward & Goldstone, Greenwood & Batley, Westinghouse and Thornycroft (the last-named had risen 5s in the previous week). Others to rise in price included "Ekco," Desoutter, Scottish Cables and Cossor.

Officially, the Stock Exchange has now ceased to use the word "bonus" in connection with shares issued free to the shareholders of a company as the result of a capitalization of reserves. These are known now as capitalization issues, and the quotation of the shares in the official lists appears in due course as "x.c.," instead of the long familiar "x.b." The change has presumably the intention of correcting the impression that these operations conve

Week's Price Changes

Company or Board	Nom. Value	Middle price 26th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
						£ s d		
Gilt-edged Stocks								
Brit. Elec. 1968/73	100	95		3	3	3 3 2	95	88⅞
Brit. Elec. 1974/77	100	94½	+⅛	3	3	3 4 0	94½	87½
Brit. Elec. 1976/79	100	100	+1⅛	3½	3½	3 10 0	100	93⅝
Brit. Elec. 1974/79	100	109½	+1	4½	4½	3 17 10	109½	103⅜
Overseas Electric Supply								
Calcutta Elec.	£1	21/3		6†	6†	5 13 0†	21/6	18/7
East African Power	£1	20/6		7	7	6 16 7	23/4	19/6
Nigerian Elec.	£1	24/-		10	10	8 6 8	25/-	23/6
Palestine Elec. "A"	£1	20/6		Nil	Nil	Nil	20/6	16/-
Perak Hydro-Elec.	£1	15/-		Nil	6	8 0 0	15/6	13/9
Equipment and Manufacturing								
Aberdare Cables	5/-	10/6		25	12½*	5 19 0	10/6	8/1
Aerialite	1/-	12/6	+1/3	88½	88½	7 1 6	12/6	10/9
Allen, W. H.	£1	73/3		15	20	5 9 3	73/3	50/-
Aron Elec. Ord.	£1	45/-		20	15	6 13 4	50/-	43/-
Assoc. Elec. Ord.	£1	60/-	+2/6	20	11½*	3 15 0	60/-	41/6
Automatic Tel. & El.	£1	70/-		15	15	—	71/3	57/3
Babcock & Wilcox	£1	61/6	+6d	18	12*	3 18 4	61/6	47/3
Baldwin, H. J.	2/-	4/6		20	20	8 18 0	5/6	3/9
Bakelite	10/-	26/3		12½	12½	4 15 3	27/6	23/6
British Aluminium	£1	37/-	−1/-	12	10	5 8 0	40/-	34/6
B.I. Callender's	£1	46/3	+6d	10	10	4 6 6	46/3	37/9
B.I. Callender's 6% Pref. ...	£1	26/-		6	6	4 12 3	26/-	24/3
British Thermostat	5/-	23/9		35	27½*	—	23/9	12/-
British Vac. Cleaner	5/-	14/-		25	25	8 18 6	14/6	11/6
Brook Motors	10/-	42/6		20	20*	4 14 3	42/6	33/3
Brush Ord.	5/-	6/9		4	6	4 9 0	7/-	3/6
Bulgin, A. F.	1/-	3/3		30	30	9 4 6	3/7	3/2
Burco	5/-	15/9		35	35	5 11 0*	15/9	12/1
Chloride El. Storage	£1	68/-		20	12½*	3 13 6	68/-	46/6
Clarke Chapman	£1	58/9		17½	20	—	58/9	47/6
Cole, E. K.	5/-	37/6	+1/9	25	27½	3 13 4	37/6	22/6
Cossor, A. C.	5/-	9/6	+6d	10	10	5 5 3	9/6	7/-
Crabtree	10/-	28/9		17½	17½	6 1 9	29/6	23/9
Crompton Parkinson Ord. ...	5/-	18/3		11½	20	5 9 7	18/3	14/-
De La Rue	5/-	17/-	+9d	Nil	20	5 17 9	17/3	12/3
Decca	4/-	41/6		150	35*	—	41/6	32/-
Desoutter	5/-	19/3	+6d	18	20	5 4 0	19/3	16/1
Dewhurst	2/-	6/-		19	19	6 6 9	6/3	5/1
Dictograph Tel.	2/-	6/-		20	20*	6 13 4	6/3	5/2
Dubilier Condenser	1/-	5/9		28	25*	4 7 0	6/-	4/1
E.M.I.	10/-	17/9		12	8	4 10 2	17/9	11/3
Electrical Components	5/-	13/3		20	20	7 11 0	13/3	10/9
Elec. Construction	£1	60/9	+9d	15	15	4 18 8	61/3	53/-
Enfield Cable Ord.	£1	23/9	−1/3	5	Nil	Nil	25/-	16/6
English Electric	£1	50/-	+1/3	15	10*	4 0 0	48/9	38/-
English Electric 3½% Pref. ...	£1	16/6		3½	3½	4 11 0	16/6	15/3
Ericsson Tel.	5/-	26/3	−3d	22†	25†	2 7 6*†	26/6	22/9
Ever Ready	5/-	25/-		35	40	—	25/-	17/9
Falk Stadelmann	£1	38/6		15	15	7 16 0	41/-	36/6
G.E.C. Ord.	£1	50/-	+2/6	11¼	12½	5 0 0	51/-	37/6
G.E.C. 6½% Pref.	£1	27/-		6½	6½	4 16 3	27/3	26/6
General Cables	5/-	16/9		30	30	8 19 0	16/10	16/3
Greenwood & Batley	£1	50/-	+1/3	17½	17½	7 0 0	50/-	40/3
Hackbridge Cable	5/-	15/3		20	20	6 11 6	15/3	11/3
Hackbridge & Hewittic	5/-	23/3		20	25	5 7 6	23/3	16/10
Hall Tel. Acc.	10/-	11/-		10	10	9 1 9	11/11	10/6
Heatrae	2/-	5/-		12½	12½	5 0 0	5/-	4/-
Henley's	10/-	19/6		10½	10½	5 7 9	19/6	15/6
Holophane	5/-	15/3		20	20	6 11 2	15/3	13/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

to shareholders anything in the way of a gift. It supplements the advice almost always given nowadays, by companies making such issues, that they carry in themselves no implications regarding the amount distributed in subsequent dividends. No doubt investors will continue, nevertheless, to regard "capitalization" issues hopefully from a dividend point of view, just as they will probably long continue, through force of habit, to use the word "bonus" in preference to the new official term.

...n Electrical Investments

Company or Board	Nom. Value	Middle price 26th July	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	41/3	+6d	25	45	5 9 0	41/3	26/3
I.C.I.	£1	35/6	+6d	13	15	4 4 6*	37/-	26/6
Int. Combustion	5/-	24/-		15	20	4 3 4	24/-	14/6
Johnson & Phillips	£1	48/-		15	15	6 5 0	52/3	47/6
Lancashire Dynamo	£1	57/6		12½	14	4 17 6	57/6	43/-
Lawrence, Scott	5/-	25/-		15	20	4 0 0	25/-	14/-
Lister, R. A.	£1	43/-	−6d	9	12	5 11 7	43/6	31/9
London Elec. Wire	£1	46/3	−1/-	15	10*	4 6 7	47/3	38/-
Lucas, J.	£1	33/9xc		9⅛	10⅛	3 4 3*	34/3	25/3
Maryat & Scott	2/-	7/-		22½	25	7 2 9	7/-	5/11
Mather & Platt	£1	47/-xc		12½	15	—	47/-	32/-
Metal Industries	£1	31/9xd		12	9	5 13 4	42/3	29/6
Midland Elec. Mfg.	£1	67/6		15	15	4 9 0	67/6	63/-
Murphy-Richards	4/-	20/-		40	40	—	20/-	11/4
Murex	£1	54/-	−6d	15	15	5 11 1	57/-	50/-
Newman Ind.	2/-	2/4½		10	10	8 8 5	2/6	2/-
Oldham & Son	1/-	3/-		35	17½*	5 16 8	3/4	2/5
Pannall (Yate)	5/-	7/-		6	8	5 14 3	7/-	4/3
Parsons, C. A.	£1	55/-		12½	7½*	2 14 6	56/3	38/1
Plessey	10/-	56/-		25	30	—	56/-	37/10
Pye Deferred	5/-	26/6xd		20	20*	3 15 6	28/9	15/7
Revo	10/-	15/3	−2/-	27½	9*	5 18 0	20/3	15/3
Reyrolle	£1	90/-		12½	13⅜	3 1 0	90/-	66/-
Rheostatic	4/-	12/6		19	20	6 8 0	12/9	11/-
Richardsons Westgarth	5/-	11/9	+6d	15	15*	6 7 9	11/9	6/6
Scottish Cables	4/-	18/6	+1/-	20	27½	5 19 0	18/6	12/11
Siemens Ord.	£1	39/-	−6d	10	10	5 2 7	43/9	33/9
Smith (England), S.	4/-	11/6		12½	15	—	11/6	7/8
Southern Areas	£1	26/3	+1/3	6	7½	5 14 3	25/-	17/6
Strand Elec.	5/-	8/9		17½	17½	10 0 0	9/3	8/3
Sturtevant	5/-	40/-		18·1†	18·9*†	2 7 3†	40/-	29/-
Sun Elec.	£1	32/6		15	15	9 4 8	32/6	27/6
Switchgear & Cowans	5/-	12/9		22½	10	3 18 6	13/7	9/9
Taylor Tunnicliff	5/-	11/-		25	12½*	5 13 9	12/4	10/7
T.C.C.	10/-	32/6		20	30*	—	32/6	21/3
T.C. & M.	£1	33/9		10	8½*	5 0 9	34/6	30/3
Telephone Mfg.	5/-	9/-		10	10	5 14 3	9/-	7/6
Thorn Elec.	5/-	21/6		12½	12½	2 18 2	21/6	13/3
Thornycroft	£1	46/3	+1/3	15	15	6 9 9	47/6	33/4
Tube Investments...	£1	66/3		15*	15	4 10 6	68/9	60/3
Vactric	5/-	16/9		Nil	10	2 19 9	17/6	7/6
Veritys	5/-	6/9		10	12½	9 5 3	8/3	5/-
Walsall Conduits	4/-	51/3	−1/3	70	70	5 9 4	52/6	44/-
Ward & Goldstone	5/-	64/6	+1/3	45	50	3 17 6	64/6	41/3
Watford	2/-	6/4½	+1½d	25	22½*	—	6/4½	4/7
Westinghouse Brake	£1	71/3	+1/3	14	15	4 4 3	72/6	60/9
West, Allen	5/-	15/9		15	17½	5 11 0	15/9	12/7
Wolf Electric	5/-	13/9		15	17½	6 7 3	13/10	11/-
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A Ord.	100	82½		—	6	7 5 6	89½	80
Ord.	100	52½		—	3⅞	7 2 10	55½	52
Anglo-Portuguese	£1	23/9	+9d	8	8	6 14 9	24/-	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	60/-	+1/-	35	50	4 3 4	60/-	39/1
Cable & Wireless:								
Ord.	£1	37/6		8	9	4 5 4	40/6	26/2
4% Loan	100	98½		4	4½	4 1 3	98½	95½
Calcutta Trams	£1	19/-		6†	2½†	—	19/3	17/1
Cape Elec. Trams	£1	15/-		5½	5½	7 6 8	15/3	12/4
Marconi Marine	£1	33/9		10	10	5 18 6	33/9	27/6
Oriental Tel. Ord.	£1	91/3	+2/-	16	16	—	91/3	82/6
Telephone Props.	£1	5½	+½	8	8	—	5½	4½
Telephone Rentals	5/-	10/3	+3d	10	10*	—	10/3	9/-

Richardsons Westgarth Improvement

The 5s shares of Richardsons Westgarth have been well supported in recent months in anticipation of good results for the year to March last. These duly materialized with the company's declaration of a 15 per cent ordinary dividend (a single payment is made annually on the one class of capital) and of a 25 per cent expansion in the trading profit. Nearly all of this increase is neutralized by heavier tax charges, but the surplus is still about 2½ times the net amount distributed in the dividend. The latter is at the same rate as last year's, but applies to capital increased since then by the one-for-three capitalization issue, so that shareholders receive an increase equivalent in effect to 5 per cent on the old rate. After being marked up to 11s 9d, cum-dividend, the shares show a yield of nearly 6½ per cent.

Popular Rates

While the announcement of almost any capitalization issue gets a good reception (despite official warnings against jumping to dividend conclusions) the market has developed something of a preference for those made in the proportion of one new for, say, every three or four shares held. It likes, in fact, to see in prospect a sequence of events similar to that produced by the Richardsons Westgarth company (referred to above) in maintaining the previous rate of dividend on a number of shares one-third greater than before as a result of a capitalization issue. A share-for-share issue, it is thought, may mean much or little; but where the ratio is smaller the chances of the desired sequel are rated, on the basis of experience, more highly. Earlier this month Pye showed that even a one-for-two scrip distribution does not rule out the possibility of a fully proportionate improvement in the dividend.

Broadcast Relay Issue

New 5s ordinary shares of the Broadcast Relay Service Company, offered to shareholders at 32s 6d in the proportion of one for every ten held, have changed hands at premiums varying between 15s and 12s 3d since the start of dealings. The premium was 14s at the time of last week's annual meeting. Results for 1953–54 had disclosed another step forward in the expansion of this company's earnings. Uninterrupted progress since the war, and the succession of moderate increases in the rate of the ordinary dividend, have made the shares one of the most profitable of recent investments in the industrial market. For the latest period, the distribution has been raised from 18 to 22 per cent, and the company hopes to be able at least to maintain that rate next year on the larger capital.

REPORTS and DIVIDENDS

Broadcast Relay Service, Ltd.—In the course of his speech at the annual meeting held on 23rd July, Mr. J. S. Wills (chairman and managing director) said that a new company, Rediffusion Vision, Ltd., had been formed with a subscribed capital of £1,060,000, which was responsible for the manufacturing and rental organization supplying aerial television receivers and vision terminal units for the wired television services. Broadcast Relay Service retained the majority of the equity capital of that company, but the whole of the £1,000,000 of preference share capital and a part of the equity capital had been taken up by their associates, the British Electric Traction Co., Ltd.

At home the rediffusion sound services continued to attract a steady flow of new subscribers, and in practically all the existing areas of operation the number of subscribers had increased. The wired television services were progressing satisfactorily. Following the issue of the new long-term licence which had now been agreed with the Post Office, one of their primary objects would be to supply additional sound programmes. This involved the overhaul of the existing network and the addition of further wires or cables. The additional network would also suffice to enable them to give a wired television service. The work involved and the amount of capital required would be considerable and the conversion would take some years to complete. After referring to progress overseas, the chairman said the manufacturing company, Redifon, Ltd., had been producing a new type of flight simulator for the F.86E Sabre aircraft for the Royal Canadian Air Force. The design and development of various new types of flight simulators was well advanced. The order book of Redifon, Ltd., continued to be largely filled with overseas orders. Their communication equipment continued to be popular in all parts of the world for land, marine and air purposes, and the industrial radio heating equipment was now used extensively by many leading manufacturers in the United Kingdom and elsewhere.

Aiton & Co., Ltd.—Presiding at the annual meeting held on 20th July, Wing-Commander J. M. Aiton (chairman and managing director) said that the company had had a successful year's working. A new works was being constructed in South Africa by Aiton Africa Proprietary, Ltd., in which they held a 40 per cent interest, and it was hoped that it would be in production early in 1955. The chairman said that the company had supplied the steam pipes and the evaporator for Portobello power station, the first British station to operate at an efficiency of over 30 per cent. They were also supplying pipes for a nuclear "fired" power station at Calder Hall for the Department of Atomic Energy. Orders were being received at a satisfactory rate.

Thorn Electrical Industries, Ltd., proposes to issue £500,000 4½ per cent unsecured loan stock, 1972–74. The proposal will be submitted to a meeting of holders of the existing 5½ per cent unsecured loan stock, 1959–64, to be held on 6th August and, subject to consent being obtained, an offer of the stock will be made shortly after to all shareholders and unsecured loan stock holders.

The General Electric Co., Ltd.—The preliminary figures of the accounts for the year ended 31st March last show an aggregate group profit of £5,777,918, as compared with £4,230,234 for the preceding year, and after providing £3,053,711 (against £2,503,657) for taxation the consolidated net profit attributable to the holding company is £2,364,345 (against £1,266,054). It is proposed to pay a final dividend on the ordinary stock of 8¾ per cent making 12½ per cent for the year (against 11¼ per cent).

Parmiter, Hope & Sugden, Ltd.—After deducting £45,324 for taxation, the net profit for the year to 31st March last is £31,578 as compared with £37,642 for 1952–53. General reserve receives £5,000 and it is proposed to pay a final dividend of 22½ per cent (against 18 per cent), making 30 per cent for the year (25½ per cent). The balance carried forward is £27,300 (against £25,135 brought in).

The Electric Furnace Co., Ltd., proposes to pay a final ordinary dividend of 6½ per cent, making 10 per cent for the year on capital increased by a 100 per cent scrip issue. This compares with a total distribution of 12½ per cent for the previous year on the capital before the scrip issue.

Johnson & Phillips, Ltd.—Arrangements are being made to provide additional capital by the issue of 250,000 4½ per cent £1 cumulative redeemable preference shares, an extension of the 1,000,000 already in issue. The placing will be a private operation and it is understood will be through the market at a price which should yield 19s net per share to the company.

Richardsons, Westgarth & Co., Ltd.—The gross profits for the year ended 31st March, after providing for depreciation, amount to £1,013,346, as compared with £811,839 for 1952–53. Taxation at £650,324, however, is up by £184,774, and the net balance of £362,022 is therefore only £16,733 higher. The dividend for the year is maintained at 15 per cent but is paid on larger capital.

Mather & Platt, Ltd., have declared an interim ordinary dividend of 4 per cent (unchanged). The £1,363,660 new ordinary shares resulting from a two-for-three scrip issue, approval to which was given at an extraordinary meeting held on 21st July, will not participate. At the same meeting approval was also given to a proposal to raise the authorized capital from £2,500,000 to £6,000,000. Mr. L. E. Mather (chairman) stated that there was no intention at present of issuing further capital and the capitalization of reserves carried with it no implication as to the future rate of dividend.

Murex, Ltd.—The group profit for the year ended 30th April, after meeting all charges except taxation, amounts to £657,000, a decrease of £48,000 as compared with the preceding year. Taxation absorbs £390,000, leaving a net balance of £267,000, a decrease of £126,000. The ordinary dividend for the year is maintained at 15 per cent by a final payment of 9 per cent.

James Howden & Co., Ltd., have received Treasury consent to a proposed 100 per cent scrip issue. This involves an increase in the authorized capital from £700,000 to £1,500,000 and the capitalization of £546,000 of general reserves. These new ordinary shares will rank along with the existing units for payment of any further dividends to be declared for the year ended 30th April last. An extraordinary meeting will be held on 9th August to consider the proposals.

The Nigerian Electricity Supply Corporation, Ltd., reports a net profit for the year to 28th February last of £111,044, as compared with £143,304 for the preceding year. This figure is arrived at after allowing £60,000 for depreciation but before taxation of £62,300. A sum of £20,000 is placed to reserve and it is proposed to pay a final dividend of 4 per cent, plus a bonus of 2 per cent, making 10 per cent for the year (unchanged).

The Ebonite Container Co., Ltd., proposes to make a two-for-five scrip issue.

New Companies

Bristol Channel Production Co., Ltd.—Registered 27th May. Capital £2,000. Mechanical, general and electrical engineers, engineering contractors, wireless and television engineers, etc. J. Whittaker is first director. Secretary: Miss M. Evans. Regd. office: 1, Museum Place, Cardiff.

Western Electric Co., Ltd.—Registered 18th June. Capital £100. Directors: W. L. Brown, W. S. Towers, jnr., and J. H. Somake. Solicitors: Bristows Cooke & Carpmael, 1, Copthall Buildings, E.C.2.

J. G. Barnes & Co. (Hale), Ltd.—Registered 19th June. Capital £100. Electricians, radio and television and electrical engineers, etc. Mrs. Winifred M. Purvis is first and permanent director. Secretary: S. L. Purvis. Regd. office: 15, Grafton Street, Altrincham.

Liquidations

Betterway Electrical Products, Ltd.—Winding up voluntarily. Liquidator, Mr. I. D. Coutts, 69, London Street, Norwich, appointed 10th July.

Premier Electric Services, Ltd.—In voluntary liquidation. Meetings of members and creditors on 23rd August at the offices of A. C. Palmer & Co., Court Chambers, Friar Lane, Leicester, for the purposes provided in section 300 of the Companies Act, 1948.

Phillips Electrical Supplies, Ltd.—Members' voluntary winding-up. Meeting of members on 25th August at the Church Inn, Dukinfield, Cheshire, to receive an account of the winding-up by the liquidator, Mr. B. P. Evans.

Bankruptcies

K. G. Rudd, 4, Commercial Road, Louth, Lincs., radio and electrical contractor, formerly carrying on business at 52, Eastgate, Louth.—Trustee, Mr. L. F. McCulloch, 26, South Saint Mary's Gate, Grimsby, released 7th April.

C. G. Clews, 226, Stafford Street, Walsall, trading as Clews Electrical Co., electrical contractors, and as Clews Wee Bus, coach proprietor.—Trustee, Mr. R. F. Bendall, 126, Colmore Row, Birmingham, released 18th June.

H. W. Daldry, residing at 57, Lower Cliff Road, and lately carrying on business at 168, Bells Road, Gorleston-on-Sea, Suffolk, electrician.—Supplemental dividend of 5s in the £, payable at the Official Receiver's office, Castle Chambers, Opie Street, Norwich.

Parliamentary Report

IN the House of Commons last week Mr. Ellis Smith asked the Minister of Works if he had now concluded a satisfactory arrangement with the manufacturers of atomically driven electric plant, with a view to ensuring that this country remained in the forefront of world development, that new ideas were immediately applied and that the needs of customers were met.

Sir David Eccles, Minister of Works, referred the hon. Member to the reply given to him by the Minister of Fuel and Power on 28th June.

Mr. Ellis Smith asked the Minister if he was satisfied that this country will not be left behind in this development as it has been in hydro-electrification? Could he give an assurance that the closest possible co-operation existed between the Ministries and the concerns responsible for manufacturing this kind of plant?

Sir David Eccles said that discussions were continually taking place with both the British Electricity Authority and the manufacturers of this type of plant. He believed that we were ahead of other countries.

Mr. Ellis Smith also asked the Minister of Works if the paper which was given by Dr. A. Charlesby, of the Atomic Energy Research Establishment, on the cross-linking of polythene by pile radiation, and on the effect of high-energy radiation on long-chain polymers, was delivered with his approval; on what terms a licence was granted to the General Electric Corporation of America for the manufacturing rights in this project who would get the income which was the result of Harwell research; and how many applications had been made by or on behalf of German concerns to benefit from this British research.

Sir David Eccles said that publication of these papers was approved by the responsible authorities. No licence for manufacturing rights had been granted and no application had been received in this connection from any foreign firm. From 1st August, the Atomic Energy Authority would receive any income derived from commercial exploitation of the invention.

V.h.f. Broadcasting

Mr. Grey asked the Assistant Postmaster General if he would now make a statement on the question of very-high-frequency broadcasting; also what priority the north-east would have for the very-high-frequency service.

Mr. Frederick Willey asked a similiar question.

Mr. L. D. Gammans replied that after consultation with the Television Advisory Committee, the Postmaster General had authorized the B.B.C. to proceed with nine very-high-frequency sound broadcasting stations giving coverage to 75 per cent of the population of the United Kingdom. They would be situated at Divis (near Belfast), Holme Moss, Meldrum (Aberdeenshire), North Hessary Tor, Norwich, Pontop Pike, Sutton Coldfield, West Wales and Wrotham. The B.B.C. hoped to have the first station in this programme, at Wrotham, in regular service by May, 1955; the next would be Pontop Pike and Divis, and the other stations would follow at intervals over a period of about eighteen months.

British Catering Equipment for U.S. Aircraft

THE General Electric Co., Ltd., has received an order from Trans-World Airlines of the United States for 22 two-compartment air-circulation ovens to be installed in T.W.A. "Super Constellation" aircraft operating on transatlantic and American internal routes. This design of oven enables up to 60 meals of pre-cooked frozen food to be prepared simultaneously for serving to passengers, so that all can be catered for at one sitting. The G.E.C. oven has a high ratio of efficiency to weight, and this advantage is increased in the present application by making full use of its capacity. Certain smaller ovens which were considered as alternatives would not have met full passenger requirements individually, but would have provided excess capacity when used in combination. The two compartments of the G.E.C. oven are separately switched so that small quantities of food can be heated economically in one compartment if necessary.

Air heated by 500 W elements (four in each compartment) is circulated evenly by electrically-driven fans. Thermostats control the oven operating temperature. Only eight minutes' preheating is required to bring the temperature up to 400–450 deg F. A buzzer sounds when the selected figure is reached. The food is then placed in the oven and a time switch set for a predetermined time, according to the nature of the dishes being reheated. A further buzzer signal indicates expiry of the selected time.

The total maximum loading of the oven is 4,150 W at 26 V, and the weight only 88 lb. Many similar units are in use by Qantas, K.L.M., T.C.A. and other air lines. The T.W.A. model is slightly modified to conform with American practice. Miniature circuit breakers are fitted in place of fuses for protection of all circuits.

I.E.E. Periodicals

THE Institution of Electrical Engineers has announced that after an extensive review by the Papers Committee of the Institution's present publication policy, the Council has decided to effect certain improvements and changes in the *Journal* and *Proceedings* which it is hoped will make these publications of greater value and convenience to members. The new scheme will come into force next January.

In place of the present *Journal* and Part I of *Proceedings* there will be only one general publication designed to be of interest to all members. This will still be called the *Journal* and will appear monthly. Part I of the *Proceedings* will be discontinued and the *Proceedings* will be divided into three parts only as follows: Part A, "Power Engineering," to be issued in alternate months, February, April, etc.; Part B, "Radio and Electronic Engineering," to be issued in alternate months, January, March, etc.; and Part C, "Monographs," to be issued twice a year, in March and September.

Contract Price Formulæ

THE British Electrical & Allied Manufacturers' Association has issued the figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 24th July is deemed to be 150s 6d. The "cost of material" figures are:—

For electrical machinery and equipment the Board of Trade index figure published on 24th July is 159·9 (the figure for 12th June has been amended to read 159·0).

For turbo-generating and allied plant: materials used in mechanical engineering industries, 150·8, blast furnaces and iron and steel smelting and rolling (40 and 41), 145·9, price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 23rd July), 3s 6½d per lb. Outstanding contracts covered by the B.O.T. intermediate products index: the index figure for intermediate products (24th July) is 360·6.

Consent to Cotswold Line

AT the annual meeting of the Gloucestershire Branch of the Council for the Preservation of Rural England it was reported that the objection which was lodged against the route of the proposed 275 kV transmission line across the Cotswolds had not succeeded, and that the Minister of Fuel and Power had given his formal consent to the British Electricity Authority. At the public inquiry last January the Branch had supported a proposal by the Gloucestershire County Council for an alternative route through the Severn Valley.

INDUSTRIAL NEWS

B.S.I. Export Panel

The British Standards Institution announces the formation of a small Export Panel consisting of leading industrialists who are actively engaged in the markets of the world. The Panel will advise the B.S.I. on how best it can assist export trade. The volume and range of overseas work connected with standards has increased greatly in recent years, and has become a factor of growing importance to our exporting industries. The development of national standards in overseas countries has a direct bearing on British manufacturers' export activities, and therefore demands that British industry should, through the B.S.I., take a leading part in influencing developments in the international standards field. Fundamentally the Institution's task in this sphere is to limit the necessity for British manufacturers to produce a variety of goods to comply with a variety of standards in different countries. One practical task of the new Export Panel will be to suggest ways in which the use of British Standards overseas can be promoted, and how availability of these Standards in all parts of the world can be improved.

Formation of the new Export Panel has been actively helped by the Federation of British Industries, and the initial constitution of the Panel is as follows:—Mr. J. L. S. Steel (Imperial Chemical Industries, Ltd.), chairman; Mr. G. H. Andrew (Under-Secretary, Board of Trade); Mr. D. Maxwell Buist (British Electrical & Allied Manufacturers' Association); Mr. Leslie Gamage, M.C. (General Electric Co., Ltd., president, Institute of Export); Sir Ernest Goodale, C.B.E., M.C. (Warner & Sons, Ltd., president of the Silk and Rayon Users' Association); Mr. Hector McNeill (Babcock & Wilcox, Ltd.); Mr. J. W. Ridgeway (Edison Swan Electric Co., Ltd.); and Mr. R. L. Wills, M.C. (National General Export Merchants' Group and London Chamber of Commerce).

Royal Chartered Colleges

We learn from *The Times* of the advocacy by the Parliamentary and Scientific Committee, in a memorandum on higher technological education just published, of the establishment of Royal Chartered Colleges of Technology with the right to award degrees. It is suggested that up to twenty of the existing colleges of technology might be considered eligible for charters and that these colleges should prove an invaluable supplement to the universities in providing the higher qualified technologist which the country urgently needs. The colleges should offer advance full-time "sandwich" courses, part-time day and evening courses, post-graduate courses and facilities for research on a full-time and part-time basis. Entry could be direct from school or by Ordinary National Certificate, but the colleges should require high qualifications for entry.

The colleges should have strong governing bodies and the Committee feels that it would be advantageous to give them complete financial independence on a quinquennial basis like the universities, with grants controlled by a special grants committee analogous to and co-operating with the University Grants Committee.

Wages in Cable Making Industry

At a meeting held on 21st July the Joint Industrial Council for the Electrical Cable Making Industry agreed that the rate of pay of a leading hand or working chargehand shall be increased to at least 2d an hour (instead of 1d) above the J.I.C. classification rate appropriate to the highest grade of work being performed under his direction. The increases in wages are to come into effect as from the beginning of the first full pay period after 21st July. Where leading hands or working chargehands are already in receipt of a total rate per hour which provides a difference of 2d or more over the classification rate for the highest grade of work performed, no further adjustment will be made.

Improved Fluorescent Lamps

Following upon the introduction a few months back of the "New Warm White" range of general purpose fluorescent tubular lamps Crompton Parkinson, Ltd., now announce that they are producing improved "Natural" lamps. These are claimed to give up to 16 per cent more light but the list prices remain the same.

Electrical Industries Club

This Club has now been running for over seven months and many well-known people in the industry have become members. The main object of the Club is to promote mutual understanding and goodwill among those engaged in the electrical industry. So far the functions have been confined to monthly luncheons, at some of which there have been guest speakers, but it is possible that the social activities will be expanded in the future if the members desire this. The luncheons are "price controlled" and strictly timed so that they always end at 2.30 p.m.

The Club's affairs are looked after by a representative committee. The chairman is Mr. A. B. Wildsmith, the vice-chairman Mr. R. Baldwin, the hon. secretary Mr. W. E. Babb (Kingsway House, Kingsway, London, W.C.2), the hon. social secretary Mr. H. F. Wickham, and the hon. treasurer Mr. H. S. Fothergill.

Applicants for membership must be principals, directors or managers of any bona fide electrical firm, company or supply authority or otherwise of responsible standing in the electrical industry or closely connected with it. The entrance fee is one guinea and the annual subscription two guineas.

B.I.F. in London

Sir Ernest Goodale, chairman of B.I.F., Ltd., announced last week the first stages in the reorganization of the London Section of the British Industries Fair to be held from 2nd to 13th May next year. He said that the London section would be held at Olympia only, the decision to concentrate this section being part of the new company's policy of providing in London a better-planned display of British goods on sound financial lines. The emphasis of next year's Fair would be on goods for both home and export, and not almost exclusively on exports as in previous years.

Lyons' Strike

At a meeting on Monday last the electricians employed by J. Lyons & Co., Ltd., who have been on strike for over three months, were addressed by an official of the Electrical Trades Union. Although there was some dissension, they were told that the strike was to continue. The cause of the dispute was the employment by J. Lyons & Co., of a supervisor who refuses to rejoin the E.T.U. of which he was once a member.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £235 15s 0d
Fire Refined 99·70%	ton £234 0s 0d
Fire Refined 99·50%	ton £233 0s 0d
COPPER Tubes ..	lb 2s 3¾d
Sheet	ton £295 15s 0d
H.C. wire and strip ..	ton £264 5s 0d
LEAD, English ..	ton £94 10s 0d
Foreign	ton £93 0s 0d
MERCURY	flask £100 0s 0d
TIN, block (English) ..	ton £755 0s 0d
ZINC, G.O.B. Foreign	ton £76 5s 0d
Electrolytic	ton £84 0s 0d
BRASS Tubes (solid drawn)	lb 1s 10½d
Sheet	ton £242 5s 0d
Wire	lb 2s 6d
PHOSPHOR BRONZE Wire	lb 3s 9½d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 20½d–20¾d

Tested Domestic Appliances

The British Electrical Development Association has published List No. 2 (cancelling the first list published in May, 1953) of "Tested and Approved Domestic Electrical Appliances for Local Authority Housing." This has been compiled at the request of the Ministry of Fuel and Power by the B.D.A. Testing and Approvals Committee and is particularly intended for the use of local housing authorities. It is recommended that appliances for new houses and flats to be built by local authorities should be selected from this list and that housing authorities, architects and others concerned should consult their Electricity Boards or other competent electrical advisers as to the appliances best suited to their particular schemes.

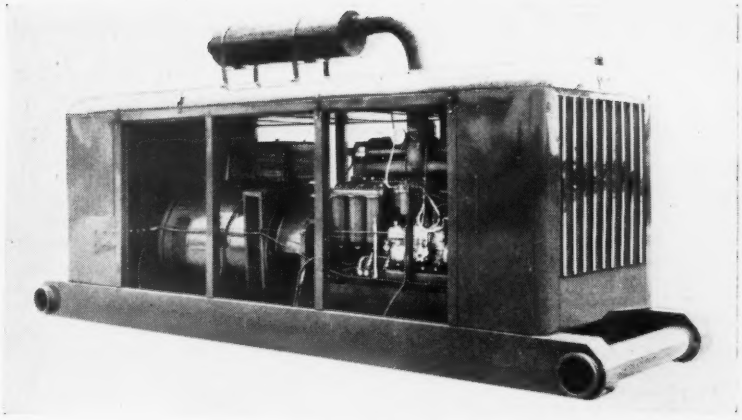
The list is confined to appliances which housing authorities may provide either as normal provision or when required. Most of the appliances are fixed or stationary in use but some portable appliances which are of an ancillary character have also been included, such as electric kettles intended for use with electric cookers.

Local authorities and housing authorities can obtain copies of the list on application to the Association at 2, Savoy Hill, London, W.C.2.

Chance Bros.' New Offices

The new office block of Chance Bros., Ltd., which has recently been opened at Spon Lane, Smethwick, has been designed to use Chance building glasses wherever they may appropriately be used and the lighting throughout makes use of various of the company's products. Fluorescent lighting has been used generally throughout the offices while in the entrance hall tungsten fittings are used. Special fluorescent fittings designed by the architects, Clifford Tee & Gale, and made by Philips Electrical, Ltd., using Chance "Luminating" glass in two pieces are installed in small offices, and other fluorescent fittings and tubes have been supplied by Thorn Electrical Industries, Ltd. The tungsten fittings in the entrance hall have been supplied by Merchant Adventurers, Ltd. The electrical wiring of the premises was carried out by Chance Bros.

The entrance hall of the new offices of Chance Bros., Ltd.



Rolls-Royce engined Petbow diesel generator

The Engineers' Guild

The Scottish Branch of the Engineers' Guild extends an invitation to fellow members who may be visiting the Scottish capital during the Edinburgh Festival of Music and Drama. To avoid interference with visitors' plans, the welcome will be informal and flexible, consisting of a cocktail party on 30th August, and visits to works and engineering plants during the Festival. Members of the Guild who expect to be in Edinburgh between 22nd August and 11th September are asked to communicate with Mr. C. M. Beckett, 8, House o' Hill Row, Edinburgh, 4 (telephone: Edinburgh 77785), so that details of the arrangements may be sent to them.

Diesel Generating Plant

Six months ago the "Vulcan" (mobile) and "Merlin" (stationary) ranges of Rolls-Royce engined Petbow generating sets were established and in the main they followed standard Petbow practice. So far firm orders have been received for 12 Vulcan and Merlin sets with a total output of 1,050 kW at normal rating. The project has aroused much interest among large oil companies and the leading contractors.

Two basic models are at present in production, both based on the six-cylinder engine. One is normally aspirated and gives 75 kW output under normal atmospheric conditions at 1,500 r.p.m., and the other is supercharged and gives 100 kW; 60 c/s models running at either 1,200 or 1,800 r.p.m. are also available. The four-cylinder engine will shortly be added to the range and will drive a 55 kW set at 1,500 r.p.m.

Electrical Officials' Salaries

In his report in the July–August issue of *Public Service* (the journal of the National and Local Government Officers' Association) Mr. L. G. Moser says that the National Joint Managerial and Higher Executive Grades Committee (Electricity Supply Industry) is now considering the scales for sub-area managers, chief generation engineers and branch heads at B.E.A. headquarters. The staff side hopes to submit proposals for conditions of service for these grades during the next few weeks.

Southport Flower Show

The rapid advance made by electricity in recent years into the realm of commercial horticulture will be demonstrated at the large and comprehensive exhibit being staged at the Southport Flower Show from 25th to 27th August by the Merseyside and North Wales Electricity Board in conjunction with the North Western Electricity Board and the British Electrical Development Association. The propagation section of the exhibit will be a completely equipped 45ft propagating house in which the apparatus will include a transformer operating a full length electrically warmed bench under thermostatic control. A small section of this bench will be separately controlled and especially designed to facilitate rapid and economical germination of seedlings. Above the bench will be several types of mercury vapour lamps for plant irradiation. The space heating will be by fan heaters.

A new feature in propagation technique to be demonstrated will be the control of the plant irradiators by a photo-electric cell. This control is set so that the irradiators operate only when natural light conditions are poor.

There will also be in the propagating house a section devoted to border soil warming for the production of tomato and cucumber crops. The house will

be supplied and erected by Henry Alty, Ltd. Adjoining the propagating house will be a commercial type frame illustrating the use of electrical soil warming and frost protection equipment. In the soil preparation section there will be an electrical soil sterilizer, a soil shredder, and an electrical pot washing machine. Amongst the other electrical aids to nursery efficiency will be exhibited a forced draught unit, water pumping apparatus and a circulating pump for commercial heating installations.

New Southampton Cable Factory

A new factory is to be erected at Southampton New Docks by Standard Telephones & Cables, Ltd., which will be equipped with the latest machinery and facilities for the production of submarine telephone cable and submerged repeaters. A nucleus of experts and technicians from the company's organization at North Woolwich will initially start this new factory but it is anticipated that the main body of the employees will be obtained from local districts. The selection of Southampton was made because of the town's position with regard to rail and sea access, both of which are important in the manufacture and shipment of this type of cable and equipment to world markets.

Canadian Imports and Exports

Canada's external trade in electrical apparatus during the first quarter of this year showed little change in value on the import side. The total was $46,224,000. Declines in power plant were offset by increases in storage batteries, radio goods, telephone apparatus and some other appliances. There was a 30 per cent fall in imports of refrigerators, nearly all from U.S.A. Television sets came in to the value of $601,000 compared with $681,000 during the first three months of 1953.

Canada's exports of electrical apparatus, January—March 1954, totalled only $4,060,000 in value against $10,760,000. Some leading items were radio goods to the value of $900,000, a fall of $6,220,000 on the corresponding period of 1953; telegraph and telephone apparatus, $367,000 (— $140,000); motors, $226,000 (— $203,000); meters and parts, $330,000 (+ $106,000); and dynamos, generators and parts, $50,000 (— $727,000).

Smoke Abatement Conference

Sir Hugh Beaver, chairman of the Government Committee on Air Pollution, is to address the annual conference of the National Smoke Abatement Society at Scarborough on 22nd September. The proceedings at the conference will include the Des Voeux Memorial Lecture by Sir Edward Salisbury, secretary of the Royal Society, on "Air Pollution and Plant Life" and the presidential address by Sir Ernest Smith. Other aspects of the problem to be discussed will be developments towards smokeless operation on the railways and in the use of gas and electricity for industrial purposes.

Radar for Egyptian Navy

Marconi's Wireless Telegraph Co., Ltd., has received a contract for navigational radar equipment, radio transmitters, receivers and associated test equipment for use aboard five warships of the Egyptian Navy. The vessels to be fitted are the *Tarek*, *Aboukir*, *Damietta*, *Rashid* and *Ibrahim*. Each ship is to have an installation consisting of a Marconi "Radio locator IV" and a "Transarctic" transmitter/receiver. There will also be a further complete "Radiolocator IV" to assist in training and maintenance. In addition, eight Marconi communications receivers of various types will be supplied for allocation among the ships. The associated test equipment is to be supplied by Marconi Instruments, Ltd.

The installation will be carried out at Alexandria under the supervision of engineers of the Marconi International Marine Communication Co., Ltd. The main items will be delivered in approximately three months.

Mobile Demonstration Unit

To facilitate demonstration of its electric food mixers, liquidizers and steam-or-dry irons at agricultural shows and similar functions, Kenwood Electrics, Ltd., has had an attractive mobile trailer unit constructed. An extending canopy is provided to give protection to the audience in wet weather and the accommodation includes a small office and a kitchen equipped with cooker, refrigerator, etc. It is probable that the unit will be employed also for indoor exhibitions on appropriate occasions.

Kenwood mobile demonstration unit

Trade Announcements

The **Metal Box Co., Ltd.**, and its associates **Brown, Bibby & Gregory, Ltd.**, and **Flexible Packaging, Ltd.**, have moved to Cambridge House, 148–150, Great Portland Street, London, W.1 (telephone: Langham 9611).

A new depot specifically for dealing with the repair and servicing of electric fences has been opened by the **Wolseley Sheep Shearing Machine Co., Ltd.**, at its Birmingham works.

The address of **Mr. John H. Shirley**, manufacturers' sales agent, is now 22, Delancey Street, London, N.W.1 (telephone: Gulliver 3524).

The **John Thompson** group of companies has opened a new branch office in the North of England at "Ravenswood," Westfield Lane, Ryton-on-Tyne, Co. Durham.

Catalogues and Lists

Nelson Engineering Co., Ltd., Netherfield Road, Nelson, Lancs.—Illustrated catalogue giving a representative view of the company's products, together with a set of transformer, motor and general catalogues.

The Superheater Co., Ltd., 53, Haymarket, London, S.W.1.—"Power Plant Superheaters"—a 72-page illustrated catalogue devoted to the contribution of the company's progress in steam power production.

Black & Decker, Ltd., Harmondsworth, Middx.—Re-designed (1954) edition of the company's catalogue of portable electric tools including data relating to their design and application.

Falk, Stadelmann & Co., Ltd., 91, Farringdon Road, London, E.C.1.—32-page illustrated priced catalogue of commercial lighting fittings (801/54).

A. F. Bulgin & Co., Ltd., Bye-Pass Road, Barking.—Catalogue of radio, radar, television, telecommunication and electronic and electrical components (193).

S.L.X., Ltd., Brunel Road, Acton, London, W.3.—Illustrated folder giving particulars of, and operating instructions for, the "Skylux 54" thrust borer.

Benjamin Electric Co., Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.—Two folders produced in connection with lighting for the packaging and colliery engineering and allied trades.

Eric H. Bernfeld, 282, Kingsland Road, London, E.8.—Technical catalogue relating to the Boley & Leinen universal precision lathe "WW82."

Elliott Bros. (London), Ltd., Elstree Way, Borehamwood, Herts.—Technical leaflet on the "Elliott 402" high-speed digital computor.

Pressed Steel Co., Ltd., Cowley, Oxford.—Illustrated broadsheet dealing with "Prestcold" refrigeration and general equipment.

Engineering in Europe

Abstracts from Foreign Technical Journals

THE general practice of earthing urban l.v. distribution systems through water mains introduces the danger of high voltages being impressed on the water mains at earth faults in earthed h.v. systems. This danger is intensified by the progressive interconnection of the distribution systems which makes the occurrence of earth currents of the order of several kA in the case of severe earth faults quite possible.

Although the configuration of water mains systems is mostly rather irregular, a satisfactory, if idealized, approximation is obtained by considering a system of mainly radial layout, on which the analysis presented is based. It is shown that the voltage distributions in a.c. and d.c. conditions do not differ appreciably and may be conveniently represented in a polar network of 100 m mesh width, provided the electrical parameters of the water mains system are known accurately enough (which they are).

The calculation is carried out numerically and the results are compared with experimental results obtained on a simple network model; the agreement is satisfactory, if cross impedances are neglected (which is permissible). Impulse phenomena were investigated on a modified model, since in this case the influence of the inductances becomes predominant, and for simplifying the instrumentation, the actual tests were made with h.f. instead of voltage pulses. Fourier analysis of the frequency spectrum proves that the character of a distribution of impulse voltages may be determined by h.v. tests.—" Voltage Distribution in an Urban Water Mains System at High Voltages or Currents of Commercial Frequency or under Impulse Voltages," U. Gugelmann, M. Jacot and E. Ruoss, *A.S.E. Bull.*, Vol. 45, pp. 213–219, 3rd March, 1954, in German.

Booster Transformer Protection

Modern booster transformers used for longitudinal voltage control mostly consist of two transformers with separate magnetic circuits, but built into one frame or casing; the first of these, i.e., the regulating auto-transformer with tappings for buck and boost, is supplied from the l.v. winding of the main transformer, and the second, known as the series transformer, from the auto-transformer, its secondary winding being connected to the neutral terminals of the main transformer h.v. winding.

The problem considered is the differential and over-current protection of the booster group and whether the first of these may be united with the differential protection of the main transformer. Several possible variants of protection circuits are suggested and their response is analysed. One difficulty consists in avoiding the response of the protection to regulating currents and keeping it sensitive to internal short circuits in the regulating transformers. With some of the usual differential protection circuits this is impossible, except at short circuits in the primary winding of the auto-transformer; with other circuits only when relays with damper windings are used.

Similar difficulties are also encountered in protection circuits in which the relays are connected through saturable transformers. The overcurrent protection must distinguish between internal and external short circuits, which is obtainable by inserting a " blocking " current relay into the main transformer circuit. The authors do not pretend to have found a standard solution of a complex problem which, in itself, is not always the same, but their analysis of various types of circuits under many different operating conditions will be helpful in finding solutions for concrete cases.—" Relay Protection of Booster Transformers for Longitudinal On-Load Voltage Regulation," B. Ya. Smelyanskaya and A. B. Chernin, *Elektrichestvo*, No. 5, pp. 18–23, 1954, in Russian.

Surge Divertor Arc Quenching

The follow-up current passing through the divertor is supplied by the generators of the system and its amplitude and wave form are determined by the inductance of the circuit in which it is set up and the parameters of the working resistance of the divertor. For the arc to be quenched at the first zero of the follow-up current the recovery voltage must remain below the gap recovery strength. If there are re-ignitions, the divertor does not operate correctly. Conditions may be improved by shunting a capacitance across the divertor which, however, must not be too small since it then is not only ineffective, but may also set up natural oscillations rendering arc-quenching even more difficult.

The author carries out a theoretical analysis of the relations between gap strength and recovery voltage of the system stepwise by removing ever more of the simplifying limitations, eventually establishing the limits of successful divertor operation in terms of the short-circuit current at the place of erection of the divertor. The influences of the distortions of the wave form of the follow-up current, of the phase difference between generator e.m.f. and follow-up current, and of the initial breakdown strength of the divertor gaps on the correct divertor response are analysed separately.—" Quenching of the Arc of the Follow-up Current in Valve-Type Surge Divertors," L. I. Ivanov, *Elektrichestvo*, No. 4, pp. 17–23, 1954, in Russian.

Selective Protection

The author discusses a method of selective system protection solely based on the capacitive current circulating at the instant of an earth fault occurring somewhere in the system. To keep the treatment as general as possible, the case of a number of relatively long feeders departing from the same substations is considered; the calculation can be simplified by neglecting the line voltage drop as well as the voltage drop across the arc at the fault point. These limitations may be lifted successively. The case of the protection of a single feeder departing from the station would be simple to handle, but the author shows the modifications of the protective circuits to be introduced if this single (independent) branch feeder is one of several issuing from the substation and then those required for a closed loop.

External faults are also taken into consideration, as well as the influence of transformers inserted in the distribution lines on the current distribution. Ample use is made of graphical methods and useful tabulations of line impedances

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

are presented. The special part of the paper considers in more detail single feeders, radial feeder arrangements and identical parallel feeders, ending with a numerical example relating to a 30 kV system, of which the actual design of the protection system, including device and arrangement of the relays, and mode of its operation are indicated.—" Selective Protection by Capacitive Currents at an Earth Fault in a System with Isolated Neutral," A. Collet, *R.G.E.*, Vol. 63, pp. 143–155, March, 1954, in French.

Pulse Generator Circuits

The problem of generating from an available alternating voltage pulse trains of given amplitude and phase relations, often arises in communication and rectifier engineering. It is comparatively simply solved by circuits comprising a saturable reactor as the non-linear element, best of all a reactor on a core of a material having a near-rectangular hysteresis loop (e.g., " Permanorm 5000 Z "). Provided that the circuit is suitably designed and well matched to the reactor characteristics, this generator type may equal any valve circuit in precision of operation and will obviously be superior to it in low power consumption, and in long and trouble-free service.

The author considers the theory of pulse generation by a saturable reactor on quadripole theory and the principles of phase control of the pulses, then applying the theoretical results to a Grätz bridge circuit, by way of example, since many other combinations of linear elements with one-way switches are suitable for the purpose, and even better than the simple bridge circuit which really answers perfectly only in no-load conditions. Asymmetrical rectangular or triangular (saw-tooth) pulses require the superposition of a d.c. on the bridge current. The principle of the combination of single-phase circuits for obtaining multiphase circuits is briefly indicated.—" New Pulse Generator Circuits using Saturable Reactors," H. Grasl, *E.u.M.*, Vol. 71, No. 11, pp. 281–287, 1st June, 1954, in German.

Restriking Voltage Calculations

Literature on the determination of restriking voltage is very plentiful and workers of many nations have contributed to it. However, the practical transmission and distribution engineer has rarely an opportunity of going through a mass of highly theoretical papers before he can deal with his own urgent problems. What is therefore required is a working method based on the correct consideration of physical conditions in the fairly complicated circuits of modern distribution systems and of the characteristics of typical modern switchgear and yet using all the simplifications possible and compatible with the required accuracy of the results.

The author's analysis of the problem uses operator calculus and Laplace transforms and explains the reduction of single, double and triple-frequency circuits to their simplest basic circuits, tabulating the most frequently required transforms for the reader's convenience. The calculation is also facilitated by curve sheets for the calculation of the natural frequencies of all the types of circuits discussed.

A special section is devoted to the selection of suitable equivalent circuits for generators, transformers, reactors and overhead and cabled lines, after the appropriate and permissible simplifications of the original circuits. These equivalent circuits are also listed in a comprehensive tabulation. A large number of partly and fully worked examples illustrates the actual procedure in characteristic cases.—" Calculation of the Restriking Voltage of Distribution Systems," R. Gert, *Elektrotechn. Obz.*, Vol. 43, No. 2, pp. 71–95, February, 1954, in Czech.

60 YEARS A

A REMARKABLE idea (and no doubt a surprising one to most people) of the types of domestic appliances on the market sixty years ago and the terms available for acquiring them is given in a leaflet kindly lent us from the archives of the London Electricity Board by Mr. H. J. Randall, its chairman. Issued in July, 1894, by the City of London Electric Lighting Co., Ltd., with which Mr. Randall was connected from 1910 until nationalization, the publication, besides revealing an unexpectedly high stage of development, brings a refreshing reminder of the days when health

Some of the domestic electrical appliances available for sale o

Electric Cigar Lighter.

(Bulk Tariff.)

Price, from £1 1 0

Also arranged on a Bracket to fix on wall.

Saucepan.

1 pint £1 10 0

2 2 0

Flat Iron.

7 lbs. £1 10 0

1 15 0

Hat Irons.

£1 15 0

Billiard Irons.

£2 5 0

Electric Hot-pl

Rectan

9½" 11½"

12" 16"

£1 1

2 2

Radiator.

Made in wrot. or cast iron.

Round, 6" diam. £2 10 0

Square, from 3 10 0

Hire, 3 6 per Quarter.

Electric Kettle.

1 pint £1 15 0

2 2 0

2 10 0

3 10 0

Hire, 3 6 per Quarter.

Facilities Available for Domestic Electrification

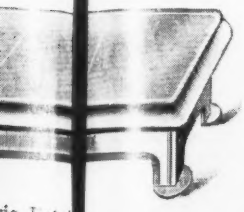
competition with gas prevailed and when it was not considered unethical to point out in forcible terms electricity's undisputed advantages.

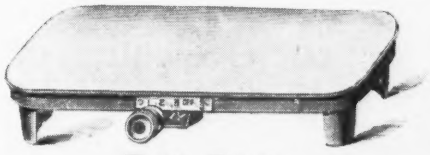
Headed " Cooking by Electricity: Absolutely the Best System of Cooking," the leaflet cites Matieu Williams " whose works on cookery have become classic " as stating that " the ideal cooking arrangement is an oven which will radiate heat from all directions upon the food to be cooked."

This ideal," continues the leaflet, " has now been realized by the application of electricity to cooking. The electric oven is the *only* one that fulfils these conditions. It is not an experiment. It is a practical success."

On the back of the leaflet there is an announcement to the effect that the company is in a position to sell or hire electric cooking and warming appliances and to supply electricity for cooking, warming and motive power at 4d per Board of Trade unit. Then follows a further list of the advantages of electricity for heating and cooking: " Safer than gas, simpler than gas, more economical than gas, better than gas in every way, no danger, no combustion,

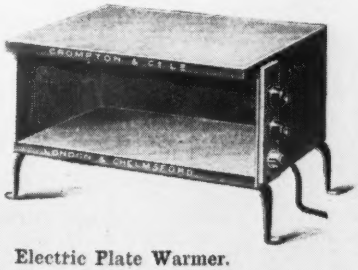
sale or hire in 1894 are illustrated in this reproduction of a leaflet published by the City of London Electric Lighting Co., Ltd.





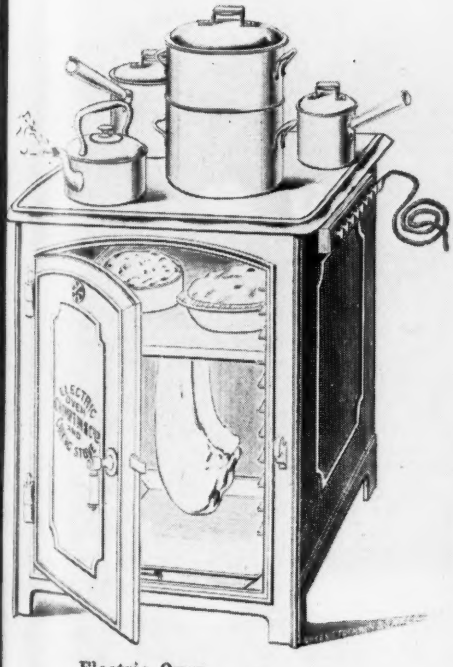
Electric Hot-plate.

	£1 1 0
	1 10 0
	1 15 0



Electric Plate Warmer.

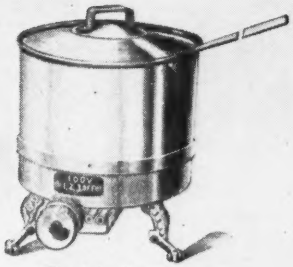
Price.	Hire per Quarter.
£2 10 0	2 6
3 3 0	3 6



Electric Oven.

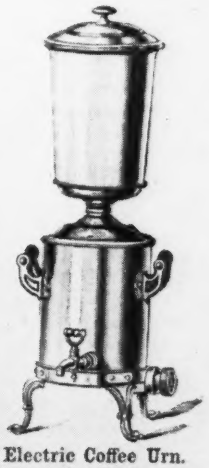
Price.	Hire per Quarter.
£7 10 0	7 -
8 10 0	7 6
10 10 0	9 -
14 14 0	12 -

Hot-plate with Handle.
£1 10 0



Electric Saucepan.

Single Circuit. Fast.	Double Circuit. Fast and Slow.
£1 17 6	
2 5 0	
	£2 10 0
3 5 0	3 15 0
	4 15 0



Electric Coffee Urn.

	£5 15 0
	6 15 0

Tailor's Iron.

	£1 18 0
	2 2 0

Electric Kettle.

no chimney, no fires to light and watch, no matches to look for, no heat wasted, perfect regulation, no more burnt meats or pastry, no explosions, pure air and cool kitchens."

A final " salvo," in somewhat heavier type, declares that " electricity is the only sanitary method of preparing food, with entire absence of fire, smoke, smell, dirt and, most important of all, no poisonous gases around food while cooking."

A list is given of the various appliances available: ovens, hot-cupboards, grills, footwarmers, hotplates, kettles, fish kettles, cigar lighters, coffee machines, saucepans, radiators, flat irons, curling tong heaters, motors, etc., some of which we are inclined to look on as quite modern developments. The accompanying illustrations of some of the appliances are interesting not only for comparison with modern designs —and some of the apparatus does not seem basically to have changed a lot—but also for the prices. Ovens were supplied in sizes from 21in by 12in square to 24in by 18in square at from £7 10s to 14 guineas or on hire from 7s to 12s a quarter. A three-pint kettle cost £2 10s (3s 6d a quarter), a 12in by 16in hotplate 2 guineas (2s 6d) and a square radiator from £3 10s (3s 6d). A two-pint coffee maker was available for £5 15s, and a cigar lighter for a guinea. In view of the present-day tendency towards weights of 2–3 lb it comes as a shock to find domestic flat irons (£1 10s and £1 15s) weighing 7 lb and 14 lb; a tailor's iron is listed as 16 lb and 21 lb.

Alkali Works Inspector's Report

THE 90th report on alkali, etc., works, covering the year 1953, by the chief inspector, has just been published (H.M. Stationery Office, price 2s 6d net).

The report contains accounts of and conclusions drawn from visits which were made jointly with Mr. A. N. East (now retired but then chief engineer, Electricity Division, Ministry of Fuel & Power) to a number of power stations mainly for the purpose of examining the steam raising plants and the means provided (or proposed) for cleaning up the waste gases before their discharge to atmosphere. The report mentions the method used at one power station for disposing of the large quantity of grit caught in the arrestors. The topsoil of neighbouring low-lying ground was removed and the grit laid down to a depth of, say, 12ft. A layer of topsoil 18in thick was then spread over the surface. Low-lying, water-logged land thus reclaimed has proved suitable for grazing cattle and raising crops.

In January, 1953, a meeting with the local authorities concerned revealed that there was still much complaint relating to emissions from three power stations in the district containing a London Transport power station which was said to be responsible for particularly heavy emissions of smoke and grit. At the end of the year further representations were made and a question was put in the House. The matter was taken up with the chief engineer of London Transport and discussions continue.

Complaints of smoke emissions from two old peak load power stations were also jointly investigated in conjunction with Mr. East and the conclusion was reached that all reasonable steps were taken to avoid smoke emission but that a certain amount was unavoidable when the boilers had to be brought quickly into full operation to meet calls for extra energy output from the station.

Somewhat similar conditions existed at another old station used only at peak load periods, but in this case there were 16 mechanically-stoked, solid-fuel boilers and two oil-fired boilers. Only two were furnished with grit arrestors. Provision of arrestors to the others could only be achieved at the cost of major structural alterations. The fuel consumption was, however, relatively small and it was quite likely that a substantial proportion of the admittedly heavy grit which fell in the neighbourhood came from other sources.

Three visits have been paid to the Battersea power station for the purpose of assessing the extent and efficiency of gas washing as practised there for the removal of sulphur oxides from the boiler waste gases. Spot tests were made on each occasion and the laboratory records examined so as to enable assessments to be made relating to the period that had elapsed since the previous visit. At the A section of the station waste gases were delivered to a flue running the full length of the station and terminating in the washers and chimneys known respectively as the N.W. and the S.W. washer and chimney. The N.W. washer is undergoing a complete rebuild and has been by-passed throughout the year.

At the B section waste gases pass to the N.E. chimney at the base of which is a washer similar to those at the N.W. and S.W. chimneys. This washer was in full use from January to the end of May when B section was shut down until 9th July. Soon after restarting undue pressures developed in the washer and after a period of erratic functioning through September, examination revealed a complete collapse of the packing. The washer was taken out of commission in early October and is to be completely rebuilt. In the meantime the unwashed gases are being passed directly into the N.E. chimney. The sulphur contained in 823,000 tons of coal was 7,660 tons. Approximately 3,120 tons of this was retained in the ash and by the washing process. The remainder, 4,540 tons, escaped to atmosphere in the form of oxides of sulphur and for the most part in very dilute concentration.

Visits were also paid to the new Bankside B power station where gas washing is also practised. The station, which is designed to burn oil with a maximum sulphur content of 4 per cent is provided with washing plant designed to remove 95 per cent of the oxides of sulphur from the waste gases, so that the final escape shall contain not more than 0·05 grain (as S) per cu ft measured dry, at N.T.P. and adjusted to 10 per cent CO_2 content. In each half of the station there is a large chamber built of cast iron, packed with timber and liberally irrigated with water. There are two passes in series in each chamber through which the gas passes and provision is made for discharging the washed gas at a height of 300ft and at a velocity of from 60ft to 120ft per second. Pumps have a combined capacity of 220,000 gallons per hour of water into which 50 per cent chalk slurry is injected as necessary. Water leaving the chambers passes through aeration chambers and oil separators before it is returned to the river. The station was commissioned in the earlier part of the year but the gas-washing plant was not operated until mid-July.

On the basis of an average of 0·024 grain of sulphur per cu ft in the waste gas from 23,430 tons of oil, the discharge of sulphur from the time gas washing began up to the end of December amounted to 21 tons. The sulphur retained by the washer amounted to 822 tons.

Power for Canadian Industries

RECENT studies indicate that a further 560,000 h.p. can be developed by Northwest Power Industries, Ltd., in the Northern British Columbia–Yukon area, in addition to 4,300,000 h.p. previously shown to be capable of economic development.

Construction of the first 680,000 h.p. stage can be undertaken as soon as interim licences are issued by the federal and provincial governments, according to a recent statement by Mr. J. L. Litchy, general manager of Quebec Metallurgical Industries.

Metals Creepage

A Study by the National Physical Laboratory

By A. G. THOMSON

IN 1946 a short conference on creep in metals was held on the initiative of the National Physical Laboratory with the object of drawing attention to the advances that were being made in the development of machines operating at high temperatures, and the need for a fuller understanding of the means by which strength at high temperatures may be secured in metals and alloys.

At that period the aircraft gas turbine was relatively new. It had been developed during the war as a fighter engine, and was a small engine with outstanding power-weight ratio and short life. The special heat resisting alloys in it had been developed on the basis of a life of 300 hours, or less. Since then the gas turbine has been successfully applied to commercial aircraft and to ship propulsion and its use in power generation is being actively explored. These applications require, in general, larger engines, longer lives—up to 100,000 hours in many cases—and high thermal efficiency. The upward trend in steam temperatures has also created a need for materials capable of withstanding these conditions for longer periods without loss of strength.

In view of the progress made during the past eight years in the study of plastic deformation and also of fracture, a symposium on these subjects was recently held at the National Physical Laboratory, Teddington, Middlesex. In both fields new ideas have arisen, and the aim was to discover to what extent they illumine matters that were previously obscure. The conference aroused world-wide interest and was attended by over 150 delegates. Among the countries represented were Australia, Belgium, France, Germany, Holland, Italy, Japan, Norway, Sweden, Switzerland, the United Kingdom, the U.S.A., and the U.S.S.R.

Creep-Resisting Alloys

The work of the National Physical Laboratory was reviewed by Dr. N. P. Allen in the introductory paper. It falls into four main classes, namely: (1) Behaviour of creep-resisting alloys over very long periods; (2) influence of the method of manufacture; (3) study of new types of alloys; and (4) fundamental studies of creep processes.

Most of the special creep-resisting alloys depend for their strength on the production of an essentially unstable precipitation hardened condition. The possibility that these alloys would lose their strength during prolonged service at high temperature caused a certain amount of anxiety among designers and one of the tasks of the N.P.L. was to examine this point in an extensive series of tests lasting 10,000 hours or more. Many examples of creep-resisting alloys have been examined, and the results are reassuring in so far as they have shown that the alloys that have been developed industrially are apparently chosen on metallurgically sound lines and have displayed no liability to sudden and disastrous change. When engines are designed on the basis of a limited permissible deformation, and the alloys are creeping continuously in service, the stress that can be applied must necessarily diminish as the endurance of the engine increases. These experiments have made it possible to assess the magnitude of the necessary decrease.

The sacrifice of working stress necessary to secure a long life may be large, and depends principally on the working temperature. Each material has a temperature range in which it ceases to be able to bear useful loads for a sufficiently long time. The practical conclusion is that it is sound practice to lower the working temperature of a gas turbine engine as the expected life is increased and that, on the other hand, if high thermal efficiency is required, some sacrifice of working life may be necessary. In designing large machines, the question arises whether large components will have the same properties as the small rolled bars on which experimental creep tests are made. In practice, the large components have generally proved to have creep resistance at least equal to, and often better than, that of small bars of the same composition, provided always that the technical difficulties associated with the manufacture of large articles have been satisfactorily overcome.

Ferritic and Austenitic Steels

As a result of the successful development of the gas turbine, it has been realized that it is now practicable to raise the steam temperature in steam turbines from a maximum of 550 to 600 deg C at least, and probably as much as 650 deg C. Turbines using steam at 600 deg C are now in existence. An important problem is to know at what temperature ferritic steels must be replaced by the more costly austenitic steels. The latter are certainly superior above 650 deg C, but below 550 deg C they have no advantage. Between these temperatures austenitic steel appears better in short time tests, but it is sometimes feared that it will in the long run prove worse because of a tendency for the creep rate to increase continuously with the passage of time. In tests at the N.P.L. the ferritic type was represented by 0·5 per cent Mo 0·25 per cent V steel, and the austenitic type by 18 per cent Cr 12 per cent Ni 1 per cent Nb steel. The comparison after 10,000 hours of testing was strongly in favour of the austenitic steel. No sign was found after 20,000 hours of increasing creep rates in this steel, when the stresses were of the magnitude that would be employed in superheater tubes and steam pipes. An alternative to the molybdenum-vanadium steel is a 2¼ per cent Cr 1 per cent Mo steel, which is thought to be more ductile. This steel is being tested in tube and pipe form.

Progress in raising the working temperature of the austenitic steels and the nickel and cobalt based alloys was initially very rapid, but has lately been slow. The most notable advance in recent years has been the development of materials consisting of hard carbides or oxides bonded with metal or alloy. Materials of this kind were tested quite early in the study of creep-resisting alloys, but the results were uninteresting. In recent years they have been re-examined and the properties now attained are very remarkable. In tests at the N.P.L., bodies of this kind have withstood a stress of 2·25 tons/in² at 1,200 deg C for over 900 hours with less than 1 per cent extension, and at 1,000 deg C stresses of 4 tons/in² can be successfully carried for similar times. On the other hand, these materials have not yet been successfully employed in

engines because of brittleness, which leads to unpredictable and disturbing failures. It seems to be of the first importance to know whether the creep resistance and the brittleness are fundamentally associated, or whether there is hope of producing a material that has both the necessary strength at high temperature and a practicable degree of toughness.

The mechanism of fracture at high temperature is little understood. There are many materials having good strength at high temperature that are brittle, but these are of little practical use and it seems that the special quality of metal that allows it to undergo deformation without breaking cannot be dispensed with. Not uncommonly an alloy of good creep resistance is produced, but it breaks after very little extension in less time than a less creep-resistant alloy would have required, whereas other creep-resistant alloys made on similar principles may have both the desired creep rate and the ability to extend.

The basic principles of a creep-resisting alloy were discussed by A. Constant and G. Delbart, of l'Institut pour le Recherche Sidérurigique, France. They pointed out that creep-resisting alloys were required for two main purposes: for use under very severe conditions but for periods of several hundred hours only, as in aircraft jet engines; and for use under conditions much less severe but with a service life exceeding one hundred thousand hours, as in steam power plant. The conditions imposed on the materials in each of these cases are, of course, quite different, and this applies not only to their creep properties but also to their fabrication properties and to their utilization in general. In nearly all cases creep resistance cannot be considered as an end in itself; it is essential to take into consideration other necessary characteristics of the material, and the design will be a compromise between the different properties.

On the steam side, the manufacture of turbine casings, usually by casting, requires the use of steels of sufficiently high carbon content to ensure good casting, though this is often to the detriment of creep properties. In the same way, the problems of forgeability, which arise, for instance, in the manufacture of superheater tubes, make it necessary that the steel should occur as a single phase during forging. It would be of little use having a material resistant to creep if the properties of the welded joints were not comparable to those of the neighbouring metal. By reason of their chemical composition, creep-resistant alloys are difficult to weld, but the progress made in welding technique is such that this consideration is not, as a general rule, a limiting factor in the development of a creep-resistant alloy.

Corrosion

In the steam field, although corrosion has been of little importance up to the present day, it presents a serious obstacle in raising the temperature to 600 deg C at the entrance to the turbines. Such operating conditions demand the use of steels of high chromium content, 7 to 9 per cent at least, whose creep resistance is rather low, and appears difficult to improve by classical methods. The difficulty of combining good creep resistance with good corrosion resistance leads in many cases to a complete separation of the problems by using a surface coating resistant to corrosion with a creep-resistant core. This method, already used in the aeronautical industry in particular, may be a means of obtaining a solution to the problem of using ferritic steels in the 600 to 650 deg C range by protecting them with a layer of chromium or by chromizing.

In the case of the steam turbine, fatigue is of little importance, since the design stress used for the rotating parts (corresponding to 0·1 per cent creep in 100,000 hours) falls considerably below the fatigue limit as the temperature is raised. The resistance to thermal shock must be taken into consideration for materials operating at very high temperatures. Among the properties required in a creep-resistant alloy, the first and foremost is obviously resistance to creep. For a pure material it is generally assumed that a high melting point and a compact atomic structure are factors indicative of a good creep resistance. In spite of this, even the most refractory pure materials with the most compact structures do not give the properties required for modern machines, and creep-resistant materials are nearly always alloys. For these the fundamental criterion of resistance to creep is evidently chemical composition. Alloying elements may react in three different ways: by raising the temperature of recrystallization of the base material, by the presence of foreign atoms in solid solution in the lattice, and by the formation of precipitates of additional phases. Constant and Delbart emphasize the essential part played in the resistance to creep by fine precipitates of additional phases, and the importance of heat treatment by which the nature, size and distribution of these precipitates can be controlled.

Secondary Hardening

The phenomena of secondary hardening are closely related to the problems of creep resistance. Among the compounds whose formation is responsible for secondary hardening, carbides are at present the best known. It is certain, however, that studies on intermetallic compounds, nitrides and borides and their formation as a result of heat treatment would lead to spectacular developments in the field of creep-resistant alloys. The subject of the embrittlement of steels during service at elevated temperatures has been investigated at intervals over the past 30 years. Since the war there have been several instances of the cracking of steam piping after a few years of service. In many cases this occurred at welded joints and was attributed to graphitization of carbide in the steel. However, cracking was not always at the welds but sometimes at parts of piping where surface defects have been thought to be the cause. Thus the possibility of defects acting as stress raisers has had to be considered. Workers in various countries have studied the effect of notches on the creep of steels and the relation between ductility and notch sensitivity. Tensile creep tests made on a molybdenum-vanadium steel over the range 650 to 525 deg C and at stresses of from 17 to 5 tons/in^2 were described in a paper contributed by R. W. Ridley and H. J. Tapsell, of the National Physical Laboratory. A "V" notch was machined circumferentially in the test pieces. The general trend of the elongation at fracture values over the temperature range under investigation was found to be the same for the notched as for the unnotched material. The steel examined did not suffer from "notch weakening." Comparison of the creep curves for tests on notched and unnotched material suggests that, if the permissible creep during service life was limited to 0·2 to 0·3 per cent, for temperatures up to 625–600 deg C, the existence of a small surface defect would not be expected to produce a decrease in the service life for the specified creep.

In a paper by L. A. Rotherham and L. G. Tottle, of the Department of Atomic Energy, the view is expressed that, although much remains to be done, the relationship between alloying and creep behaviour already appears capable of some degree of prediction.

It is evident that the many problems in this highly complex field are being vigorously tackled and that the large volume of fundamental research in progress throughout the world must lead to further improvements in high temperature materials.

OVERSEAS ELECTRICAL TRADE

Exports Slightly Higher in First Half-year

DUE largely to there being only twenty-five working days, or twenty-four if the Queen's Birthday is included (as it is officially), the exports of electrical apparatus and machinery in June at £13,765,860 were £1,544,394 lower than in May. The results compare favourably with those for June last year when the total was £13,499,722 and bring the cumulative total for the first half year to £88,373,702, which is £944,432 above the figure for January–June, 1953.

The half-year's exports of electrical machinery as a whole were slightly up on the total for the corresponding period of 1953. Shipments of generating plant and motors rose from £15,161,777 to £15,588,447, despite reduced buying by the most important customers, Australia (£1,824,006, compared with £2,007,581), South Africa (£1,698,897, compared with £1,886,916), India (£1,123,540, compared with £1,623,414) and Canada (£768,857, compared with £1,339,665). The decline in business in these markets was balanced by increased purchases by Pakistan (from £87,751 to £322,000), Russia (from £8,689 to £922,766), Holland (from £470,163 to £717,895), Portugal (from £64,878 to £264,507) and the United States (from £189,561 to £344,891). Reduced buying by Australia (£2,318,456, compared with £2,884,979) and India (£2,062,488, compared with £2,248,433) also contributed to a comparatively small decline from £14,750,212 to £14,543,932 in exports of other classes of electrical machinery.

In the telegraph and telephone apparatus market the severe decline in purchases by South Africa noticeable in previous months has apparently abated slightly but the cumulative reduction in business over the six months stands at £735,713, the total sales to South Africa amounting to £1,173,214. This was the main factor causing the fall from £8,500,445 to £8,154,755 in exports under this classification. Among the more promising markets were Southern Rhodesia (£224,303, compared with £133,741), India (£985,704, compared with £749,292), Portugal (£382,152, compared with £130,855), Iraq (£305,783, compared with £129,219) and Brazil (£387,833, compared with £90,312).

The cable market still remains in a depressed condition

TABLE I.—ELECTRICAL EXPORTS

Class	June, 1954	Six months ended 30th June	
		1953	1954
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW...	110,728	491,211	609,547
Ditto, 10 to 65 kW ...	199,526	953,359	933,439
Ditto, 65 to 200 kW	101,000	562,654	491,561
Ditto, over 200 kW ...	175,163	612,642	1,932,214
Spark ignition engine driven	11,113	150,870	111,500
Steam turbine driven	120,098	1,046,211	468,561
Other prime mover driven...	232,027	248,197	633,382
Generators	135,189	1,628,402	1,357,552
Parts of generators	306,510	3,063,403	2,371,533
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p	177,196	740,634	1,068,245
Over ½ h.p. but under 1 h.p.	44,277	205,101	292,338
1 h.p. to 250 h.p.	383,960	2,386,464	2,376,194
Over 250 h.p.	66,031	535,919	792,865
Railway, tramway and trolley-bus motors complete and parts of all motors...	124,976	1,130,913	938,286
Motor starting and controlling gear	170,417	1,405,797	1,211,230
Converting machinery	15,490	241,549	167,803
Mercury-arc rectifiers	44,473	305,677	328,068
Transformers for lighting, heating and power (incl. coils)	822,430	6,140,865	6,137,116
Switchgear and switchboards (not telegraph or telephone)	1,240,846	8,062,121	7,910,945
Primary batteries:			
Lighting	52,947	336,077	407,225
Radio	134,929	514,320	879,867
Other	38,258	296,271	270,736
Parts (excl. carbons)...	44,980	127,065	328,627
Lamps:			
Filament, exceeding 24 V	74,090	393,304	439,643
Ditto, under 24 V	27,497	126,735	169,618
Discharge lamps, fluorescent tubes, etc.	65,631	223,045	361,727
Other lamps	12,408	106,145	165,401
Radio and television, etc., apparatus:			
Cathode-ray tubes	8,494	66,087	58,120
Other valves (not X-ray)	161,228	1,037,611	982,740
Radio and television transmitters	52,102	423,699	398,864
Commercial radio and radar equipment	908,600	4,277,269	5,974,841
Domestic radio receivers, mains	164,220	1,236,714	992,288
Ditto, battery	41,358	261,342	315,297
Ditto, other (incl. car)	12,389	101,688	68,825
Radiograms	37,049	256,805	216,648
Television sets	19,165	179,536	101,019
Public address equipment	62,858	304,538	362,366
Sound reproducing app., n.e.s.	14,287	88,364	126,985
Components and parts, n.e.s., incl. parts of valves and c.r. tubes	531,225	2,505,313	3,398,610
Telegraph and telephone installations	670,863	2,585,529	3,740,399
Telephone instruments, separately consigned	117,986	1,072,094	720,230
Telegraph and telephone parts	395,385	3,830,894	2,718,842
Line apparatus for long distance commun.	141,441	1,011,928	975,284
Cookers	86,758	271,713	400,602
Toasters	12,195	94,025	104,127
Other cooking apparatus	27,414	113,628	165,154
Parts and accessories	40,499	157,533	232,550
Space heating appliances	33,515	116,584	214,963
Water heating appliances	18,021	167,393	158,293
Other heating appliances	32,843	148,888	212,912
Parts and accessories	41,065	270,868	280,704
Irons	54,682	257,365	381,004
Arc welding equipment, a.c.	27,542	301,593	226,404
Ditto, d.c.	43,498	258,866	283,190
Resistance welding equipment	58,264	49,947	113,206
Magnetos, ignition	13,125	137,493	91,561
Sparking plugs...	128,096	689,372	870,388
Elec. appliances for aeroplanes, n.e.s.	150,663	801,264	1,190,905
Ditto, for motor vehicles, n.e.s.	223,613	1,028,113	1,398,634
Ditto, for cycles, n.e.s.	75,165	349,568	499,072
Signalling app. (incl. traffic signals)	55,553	375,680	344,693
Industrial radio-frequency equipment	19,411	75,937	133,238
Bell app. (not telegraphic or telephonic)	4,591	42,878	48,620
Instruments, commercial	135,806	809,723	896,383
House service meters (not prepayment)	124,072	488,897	723,876
Ditto, prepayment	21,823	50,774	93,887
Electro-medical apparatus (not X-ray)	52,351	219,485	275,270
X-ray apparatus (excl. tubes and valves)	50,430	358,644	283,946
Vacuum tubes	17,353	141,456	119,215
Desk fans	28,282	196,637	208,616
Ceiling fans	87,940	628,639	624,542
Vacuum cleaners	163,020	741,926	1,085,118
Floor polishers	94,983	380,841	675,093
Food mixers	39,611	227,756	282,834
Hair clippers and dry shavers	73,359	219,342	465,817
Other portable appliances	19,991	106,143	153,242
Parts	50,757	251,275	413,713
Portable elec. tools (not saws) and parts	152,672	853,224	921,543
Cables and wires:			
Telegraph and telephone, submarine	166,113	498,470	424,426
Ditto, other	252,229	4,344,072	2,130,754
Cotton, silk or art. silk insulated	32,784	391,659	237,238
Enamel, glass or asbestos insulated	85,251	552,824	416,675
Paper insulated	536,517	6,101,271	3,453,914
Rubber insulated	440,266	2,806,302	2,398,265
Other	288,391	1,823,313	1,470,989
Accumulators for motor vehicles	127,578	885,540	943,900
Ditto, traction...	12,718	94,947	148,784
Ditto, radio and other portable	28,422	263,192	178,171
Ditto, other	34,076	334,280	337,010
Parts and accessories	52,933	312,759	367,886
Elec. porcelain, etc. (incl. insulators)	115,808	487,943	541,466
Insulating cloth and tape	60,839	250,037	294,002
Other insulating material	64,461	345,633	441,399
Permanent magnets	36,411	176,721	231,275
Radio, telegraph and telephone testing equipment, n.e.s.	10,873	155,762	193,822
Scientific elec. instruments (not telegraphic or telephonic)	208,347	910,270	1,193,361
Electrical machinery, n.e.s.	113,797	521,438	756,807
Electrical apparatus and appliances, n.e.s.	568,243	3,514,005	3,333,662
TOTAL	13,765,860	87,428,270	88,373,702

TABLE II.—DISTRIBUTION OF ELECTRICAL MACHINERY, APPARATUS AND APPLIANCES

Country	June, 1954	Six months ended 30th June	
		1953	1954
	£	£	£
Channel Islands	38,015	241,024	312,583
Gibraltar	6,489	106,665	50,334
Malta and Gozo	62,586	161,280	313,178
Cyprus	73,278	262,301	409,829
Sierra Leone	9,560	142,892	80,122
Gold Coast	109,711	616,708	598,367
Nigeria	128,019	1,171,869	880,086
Union of South Africa	1,504,369	11,254,156	9,624,995
Northern Rhodesia	104,934	733,375	635,418
Southern Rhodesia	193,120	1,347,438	1,217,243
Tanganyika	64,594	315,559	333,652
Kenya	94,014	1,342,978	887,861
Uganda	24,021	439,617	412,862
Nyasaland	6,415	89,054	54,616
Mauritius	8,909	169,169	146,957
Aden	47,643	956,678	598,598
Bahrain, Qatar and Trucial Oman	73,187	627,861	767,673
Kuwait	60,876	871,729	856,119
India	1,082,584	10,234,353	7,695,323
Pakistan	466,350	884,470	3,097,564
Singapore	187,318	1,658,464	1,569,919
Federation of Malaya	223,220	1,674,373	1,356,850
Ceylon	102,118	902,750	746,678
British North Borneo	21,247	195,856	179,198
Hong Kong	163,613	1,202,751	920,171
Australia	1,743,943	9,276,367	9,114,432
New Zealand	832,227	4,720,671	4,799,257
Canada	481,999	4,416,571	3,322,809
Jamaica	64,311	371,005	378,768
Barbados	10,928	86,693	119,860
Trinidad	85,949	406,787	493,236
British Guiana	14,747	186,654	221,810
Anglo-Egyptian Sudan	63,742	683,928	616,108
Other Commonwealth countries	162,776	693,207	730,876
Irish Republic	249,386	1,878,283	1,602,977
Soviet Union	60,825	114,872	1,248,640
Finland	132,466	435,536	676,397
Sweden	320,576	1,813,244	2,130,952
Norway	246,717	1,480,490	1,452,782
Iceland	14,032	67,503	83,586
Denmark	128,723	549,291	1,109,391
Poland	40,737	625,859	468,723
Western Germany	138,414	440,353	664,621
Netherlands	603,995	2,448,046	3,366,751
Belgium	204,276	1,361,206	1,610,037
France	336,985	1,485,039	1,880,74
Switzerland	106,639	379,770	549,57
Portugal	182,984	624,073	1,349,41
Spain	287,685	1,588,778	1,413,87
Italy	206,388	1,111,881	1,400,03
Austria	21,824	244,398	443,09
Czechoslovakia	2,832	41,950	18,05
Yugoslavia	49,741	328,673	702,31
Greece	92,315	509,575	434,05
Roumania	—	174,943	1,66
Turkey	20,110	715,178	341,66
Netherlands Antilles	4,059	99,510	43,27
Belgian Congo	26,523	197,055	177,52
French Morocco	30,624	172,098	161,68
Angola	7,795	66,989	60,42
Portuguese East Africa	18,934	127,739	134,68
Syria	14,212	136,774	148,78
Lebanon	19,852	208,617	217,35
Israel	14,338	332,418	203,97
Jordan	19,841	108,253	133,07
Egypt	76,295	720,469	580,12
Libya	13,173	114,505	55,09
Saudi Arabia	68,995	274,597	335,85
Iraq	168,961	1,254,902	1,396,35
Iran	29,571	113,035	196,02
Burma	105,022	570,710	755,22
Thailand	237,658	814,446	837,98
Indonesia	23,400	442,850	252,52
Japan	19,498	240,546	232,63
United States of America	279,324	1,079,635	1,570,22
Cuba	6,505	101,304	126,83
Mexico	31,553	162,348	134,85
Colombia	62,179	342,550	364,63
Venezuela	277,473	841,558	1,004,99
Peru	34,089	196,308	217,12
Chile	22,116	161,757	183,26
Brazil	93,448	644,252	563,39
Uruguay	83,183	113,575	413,16
Argentine Republic	56,928	220,933	512,87
Other foreign countries	155,849	704,343	867,08
TOTAL	13,765,860	87,428,270	88,373,70

with the six months' sales declining from £16,517,911 to £10,532,261. Increased business was recorded with Kuwait, Pakistan, Singapore, Denmark, Holland, Portugal, Austria, Burma, Colombia and Venezuela.

Exports are analysed in detail in Table I, their destinations being shown in Table II. Apart from the products covered by these figures there are a number of other electrical items included in other sections of the official returns. The January–June exports of these include washing machines, not exceeding 150 lb weight, £1,699,532 (compared with £1,191,710 in the corresponding period of 1953); ditto, over 150 lb but not exceeding 250 lb £718,954 (£538,039); ditto, parts, £380,535 (£185,855); welding electrodes (excluding carbon), ferrous, £402,428 (£565,234); ditto, non-ferrous, £129,947 (£190,248); electric conduit tubes and cased tubes, £421,763 (£473,610); electric locomotives, £1,270,548 (£1,732,910); and diesel-electric locomotives, £1,644,461 (£345,958).

Electrical imports in June were valued at £1,945,009 and brought the total for the first half of 1954 to £7,974,777, which is £3,500,297 above the January–June, 1953, figure. The principal items were telecommunication equipment, £2,081,435; cathode ray tubes, £981,852; and valves, £794,501. Holland (£2,446,140), the United States (£1,478,592), Canada (£1,072,859) and Western Germany (£845,198) were the principal suppliers.

DUTY-FREE MACHINERY IMPORTS

WHEN the comprehensive system of tariff protection was instituted in 1932 it was provided that certain kinds of machinery not obtainable in the United Kingdom should be admitted free of duty under Treasury licences. A list of such machinery drawn up by the Import Duties Advisory Committee included certain electrical machinery. The annual value of machinery admitted under this arrangement has grown considerably and last year the President of the Board of Trade set up a committee, under the chairmanship of Sir Henry Wilson Smith, to review the position and make recommendations.

That committee has now issued a report (H.M. Stationery Office, 1s 3d) in which it recommends, *inter alia*, that the provisions for duty-free entry of machinery should continue and that the responsible department should set up a consultative committee containing representatives of industry. The basic criterion for remission of import duty should be the non-procurability of similar machinery in the United Kingdom. The administering departments should examine the possibility of applying more flexible rules in cases where United Kingdom deliveries are protracted but duty should not be remitted unless there is a substantial difference between overseas delivery dates and those of the United Kingdom.

Duty-free licensing should continue to be confined to machinery for productive industrial processes and the same limitation should be applied to plant. Applications eligible for consideration should be confined to consignments of similar or closely associated machinery or plant where the value of the machinery or plant otherwise eligible for a duty-free licence required by the individual user is not less than £2,000.

Birlec " RS " standard type furnace
The " RS " furnace has a jointed hearth plate and the heating elements are supported in slotted bricks

Furnace Standardization

Multi-Purpose Units Introduced by Birlec

THE most widely used furnace for the heat-treatment of metals is undoubtedly the batch type and experience of users' requirements has made it possible in some instances to evolve certain types of equipment conforming to a basic design which can be repeated for a wide variety of applications. Notable among these are the " RP " and " SA " type batch furnaces produced by Birlec, Ltd. The " RP " furnace, which was developed for annealing, normalizing, hardening, tempering, nitriding, pack carburizing and other processes, was designed for reliable operation at temperatures up to 1,050 deg C, or even higher under certain conditions, and was the first furnace of its kind to have additional heating elements provided on the inner face of the door to compensate for heat losses at the entrance to the work chamber.

The " SA " furnace incorporates the well-known " certain curtain " system of atmosphere control for the clean hardening of components for which a scale-free finish is essential. The arrangement consists of admitting a mixture of town's gas or charcoal-producer gas and air through a slit in the floor of the furnace vestibule. This keeps the furnace chamber purged and is designed so that when the door is opened the mixture is automatically adjusted to provide a straight-up curtain of flame across the full width of the opening. Without impeding loading and unloading operations, this " curtain " serves as a protective barrier against disturbance of the atmosphere within the chamber. These furnaces are designed for temperatures between 700 and 1,050 deg C.

The company has now decided to combine the separate features of the " RP " and " SA " furnaces in a new standard equipment to be known as the " RS " type. One of the most important improvements is in the hearth design. Instead of a single metal plate, this now comprises a number of small interlocking plates which " dovetail " together to form a single unit, or a divided plate. As provision is made for expansion at the interlocking joints, buckling of the hearth plate through heat distortion is practically eliminated.

One furnace is nominally rated at 30 kW for a standard three-phase electricity supply and heating is by heavy section tape elements of nickel-chromium heat resisting alloy. The elements are arranged in the furnace roof, side walls and beneath the hearth plate so that maximum temperature uniformity is obtained. The elements are mounted in slotted bricks so that any one can be withdrawn easily and quickly without disturbing any brickwork.

The automatic temperature controller, which is of the indicating type, operates in conjunction with a triple-pole magnetic contactor unit. It is mounted in a steel panel on the side of the furnace casing while the remainder of the electrical equipment, such as the switchgear and transformer, is beneath the furnace.

An atmosphere control system with the necessary valves, interconnecting pipework and burners is also built into the furnace, town's gas and air being fed into a small combustion chamber situated below the furnace vestibule. A removable plug at the side of the furnace gives access to the combustion chamber so that periodically this may be cleaned out without disturbing the main brickwork. For applications where a controlled atmosphere is not required and to make it suitable for the class of work for which the " RP " furnace is generally used, the " RS " model is supplied with an additional heating element on the door and without the " certain curtain " arrangement.

The size and rating of the " RS " model should meet the requirements of many users, but for those dealing with smaller types of components and lower outputs a unit of 20 kW nominal rating is also being introduced. This will conform to the same general specifications as that of the 30 kW unit but as the hearth will be of smaller dimensions and, therefore, much less liable to distortion, the jointed hearth plate will not be incorporated. In this furnace the hearth plate will consist of two single plates loosely butted together.

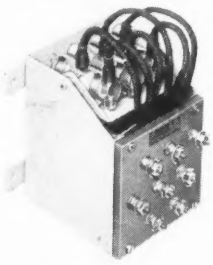
Blackpool Illuminations

Blackpool's autumn illuminations to be switched on on 10th September will employ materials and equipment which have cost £375,000. During the display, use will be made of over 50 miles of festoon strip, 75 miles of cable and wiring, 325,000 lamps and over 200 tons of other equipment. One of the features, designed to stretch from the Tower to the North Pier, is a three dimensional parade of chiming clocks.

NEW ELECTRICAL EQUIPMENT

Mercury Switch Relay

The " Tiltray " relay has been designed by BESSON & ROBINSON, LTD., 6, Government Buildings, Kidbrooke Park Road, London, S.E.3, to enable full advantage to be taken of the properties of the modern mercury switch which include the ability to switch heavy and very inductive loads on both a.c. and d.c. and to perform millions of operations without maintenance. The movement is so smooth that almost indefinite life is assured and very



B. & R. " Tiltray " mercury switch relay

heavy, very inductive loads can be switched in perfect safety, even though the supply voltage falls or rises by as much as 30 per cent.

The switches are carried in a tilting tray pivoted at the optimum point for smooth mercury flow. The armature moves this tray by " variable ratio one-tooth gears " which drop the gear ratio as the armature accelerates towards the coil. The smoothing of the armature acceleration curve thus produced is increased by the pneumatic damper, which also ensures that the tray is brought smoothly to rest. The relay chassis employed is the company's patented type " C " which gives inherently silent operation on a.c. and a coil consumption of 5–15 VA on a.c. and $\frac{1}{2}$–2 W on d.c. The armature and tray turn on stainless steel shafts in " Oilite " bearings. Materials and finishes are fully " tropicalized " (to RCS/1,000) and the maximum switching capacity is three-pole 60 A.

Domestic Refrigerator

The new 8·1 cu ft refrigerator (DE 81) brought out by the GENERAL ELECTRIC Co., LTD., Magnet House, Kingsway, London, W.C.2, possesses all those features expected in a de luxe refrigerator. There is a plain bowed door with storage racks to provide extra front row space. These include a special rack for storing eggs and fruit (ten eggs can easily be accommodated) and two other racks for jars, packages and bottles; a keeper bar on the middle shelf retains large bottles.

A full-width stainless steel freezer with a spring loaded drop down door holds up to 40 lb of frozen food, providing safe long-term storage. There is a separate shelf for the storage of ice cubes, with two ice trays each holding $1\frac{1}{2}$ lb of ice per freeze. The quick-chiller drawer in dawn-light tinted translucent plastic also occupies the full width of the refrigerator and is situated just below the freezer. It is several degrees colder than the main food compartment. The drawer has separate divisions for meat and fish and can be used for quick chilling beverages, soups, salads and the like.

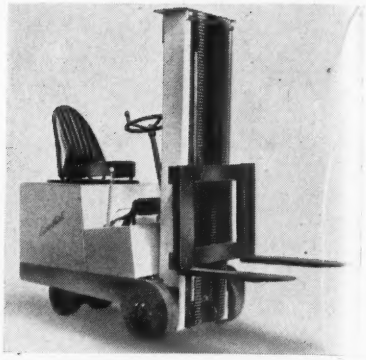
The main food compartment has two translucent plastic butter dishes and saladors. Specially designed shelf apertures to accommodate the necks of tall bottles ensure that no shelf space is lost when storing these. An eye-level thermostat provides ten temperature settings including one " extra cold." Easy-to-read enamel name strips mark the right places for storing various foods. The handle has a lock incorporated and there is an interior light. The shelf area of the refrigerator is 15·2 sq ft, the overall width $27\frac{37}{64}$ in, overall height $55\frac{11}{16}$ in, and the depth including handle $28\frac{7}{16}$ in. The price is 138 guineas inclusive of purchase tax and installation charge.

G.E.C. 8 cu ft domestic refrigerator

Electric Stackers

Special features of the battery electric stackers manufactured by LEVERSTART, LTD., 185–7, Tooting High Street, London, S.W.17, are the simplicity of control (one lever and two foot pedals control all movements and speeds of movements), maximum possible work on one battery charge, and reduction of maintenance to the minimum. The use of a patent all-electric drive and hoist and the elimination of hydraulics increases reliability, reduces maintenance, and effects considerable saving of power from the battery charge. The steering enables the vehicles to turn in their own length, the arrangement of the road wheels affording maximum stability in all conditions. The operator is comfortably seated and batteries and all parts are easily accessible.

The 10 cwt model, which costs £720 (or with tilting unit £750), has a turning circle of $42\frac{1}{2}$in and, with 48 V batteries, weighs $17\frac{1}{2}$ cwt. The 1 ton model £970 (or with tilting unit £1,010) has a turning circle of $48\frac{1}{2}$in and weighs 24 cwt. The standard length of fork is 2ft and the standard height of lift 9ft, but these figures can be varied to suit individual requirements. The maximum speed forward and reverse is 5 m.p.h., and the maximum hoisting speed raising or lowering is 25 ft/min. Ancillary equipment available includes a steel load guard for the forks, forks extension, crane and ram attachments.



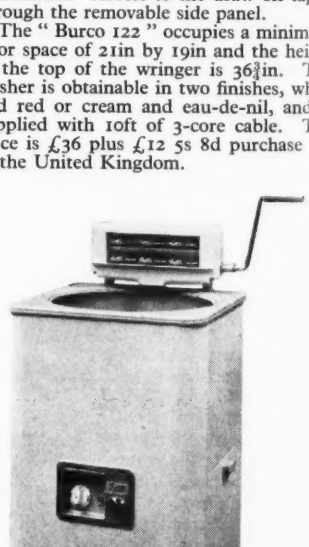
Leverstart stacker

The running cost of the vehicles, including the cost of battery replacement, shows a considerable saving when compared with petrol or diesel engined units.

Boiler Washer

Included in the range of electric wash boilers manufactured by BURCO, LTD., Rosegrove, Burnley, is a combined electric wash boiler and washing machine. The " Burco 122 " is capable of handling $5\frac{1}{2}$ lb of clothes in six gallons of water and the 2·5 kW immersion type element makes it possible to boil the water while washing the clothes. The 3-heat rotary switch control ensures efficient washing temperatures and a warning light indicates when the heater is on. A pre-set wringer has automatic adjustment and when not in use it is stowed away in the base of the washer. The agitator is of die-cast aluminium. Access to the draw-off tap is through the removable side panel.

The " Burco 122 " occupies a minimum floor space of 21in by 19in and the height to the top of the wringer is $36\frac{3}{4}$in. The washer is obtainable in two finishes, white and red or cream and eau-de-nil, and is supplied with 10ft of 3-core cable. The price is £36 plus £12 5s 8d purchase tax in the United Kingdom.



" Burco 122 " boiler washer

Professional Engineers

Their Duties and Legal Responsibilities

By C. F. MAYSON, A.M.I.E.E.

THERE is an implied term in every contract in which it could be relevant that any person who holds himself out as an engineer, in whatever capacity and whether qualified or not, is expected to exercise skill and care to the degree normally accepted in the branch of engineering in which, and at the level at which, he professes to practise; what is more, he must exercise that skill and care without negligence. Although this applies generally, its most forcible application is to professional engineers who, being members of one or more of the senior Engineering Institutions, are employed in their individual capacities as consultants.

The conduct of all professional engineers is regulated by the ethical code prescribed by the Institution to which they belong. If they hold themselves out as consulting engineers, and are members of the Association of Consulting Engineers, the rules of that Association (which do not conflict with those laid down by the Engineering Institutions) are also binding upon them. As with lawyers, medical practitioners, accountants and other professional persons, the codes of conduct are designed to ensure the maintenance of strict confidence between the engineer and his employer, and the elimination of interests which might conflict with that fiduciary relationship.

As was pointed out by Mr. J. R. Beard in his presidential address to the sixth British Electrical Power Convention,* these codes require absolute independence of manufacturing or contracting interests and prohibit advertising and soliciting of work. Whatever else may be said about them, there is no doubt that they are largely responsible for the sound reputation for integrity which the professional engineer enjoys to-day.

The rules and bye-laws of the Institutions provide that a member who contravenes these codes of conduct may be expelled or compelled to resign. Provided that he has been given a fair hearing and his case has been dealt with in accordance with the ordinary principles of natural justice, the member has no cause for complaint. It is entirely a matter between him and the Institution concerned, and the Courts will not interfere unless there has been a grave miscarriage of justice, as where the bye-laws have not been observed, the member has not been permitted to present his case, or the matter has not been handled in a *bona fide* manner.

Institutions' Disciplinary Power

Apart from any such codes, however, the law has something to say about professional engineers in their relations with those who employ them. What this is may best be shown, perhaps, by considering the position of the consulting engineer. But it must be remembered that, unlike medicine and the law, the profession of engineering is not closed and anyone, whether qualified or not, is entitled to call himself an engineer and to practise as such. The law treats all alike, although it will take cognizance of any wrongful assumption of professional qualifications. That which follows applies, therefore, to all who choose to practise individually as engineers, whether as contractors or consultants.

The term "consulting engineer" is here used in its widest sense as including any engineer, qualified or not, who is employed as an independent person under contract. He is, to all intents and purposes, the agent of his principal in relations with contractors, manufacturers and others, and his duty towards them is regulated entirely by the terms of his own contract. His duty towards his principal is also regulated by that contract, into which, however, certain implied terms must be read. These are to the effect that he will be liable for lack of skill, negligence or ignorance of the law.

Charges of Negligence

In common with other professional persons, a consulting engineer is bound to bring to his task that care, skill and competence which is generally recognized as being in accord with ordinary professional standards. If he does not do so, he will be liable in negligence under the contract. But if he is charged with negligence, he "can clear himself if he shows that he has acted in accord with general and approved practice."†

The engineer's duty of care, skill and competence is owed under his contract, and he will not, therefore, be *prima facie* liable for negligence towards those who are not parties to it (such as his principal's contractors). For example, the furnishing of estimates will normally raise no liability, because there is no guarantee that an estimate represents finality. But the preparation of a report which, due to carelessness, contains false statements and gives a misleading picture will be a negligent act under the contract. However, in the absence of fraud, there will be no liability for consequential damage to third parties. This was the effect of a recent judgment of the Court of Appeal,‡ although Lord Justice Denning, who dissented, considered that the duty of care would extend in any event to those persons whom the writer of the report knew were interested in his findings.

A contract entered into between a consulting engineer and his principal is a personal one, and the engineer's duties and responsibilities cannot be delegated without express authority. He is responsible for all acts or omissions of his employees which amount to negligence, just as though they were his own acts or omissions. But he is not responsible for anything done by someone not employed by him, unless it is done by his specific direction. Such an act, done with his authority, which causes damage to his principal's interests will raise a presumption of negligence under the contract; but if damage is caused to a third party, he may be liable to that party in general negligence. The latter liability might arise, for example, where personal injury was caused to one of a contractor's employees; it could not come under the contract, because the employee would not be a party to it.

* *Electrical Review*, 18th June, p. 1123.

† Marshall *v.* Lindsey County Council (1935), *Law Reports*, 1 *King's Bench*, 516, 540.

‡ Chandler *v.* Crane, Christmas & Co. (1951), *Law Reports*, 2 *King's Bench*, 164.

A consulting engineer is expected to have a practical working knowledge of the law so far as it is likely to affect the work for which he is responsible to his principal. Such knowledge should be sufficient to put him upon inquiry so that he may know when to suggest that his principal should obtain legal advice. But he is not expected " to supply minute and accurate knowledge of the law "; it is sufficient if he knows " the general rules applicable."§ However, it is his duty to become acquainted with any legal decision or enactment which has a bearing upon the conduct of his own practice. If he is an electrical engineer he must know and understand, for example, the provisions of the Electricity Supply Regulations, 1937, and the Electricity (Factories Act) Special Regulations, 1908 and 1944. If his interests are mechanical, he may require to have a working knowledge of, say, the Factories Acts, 1937 and 1948, and the many Special Regulations made thereunder.

It is usual to provide in the contract between a consulting engineer and his principal that the engineer is to settle points of difference between the principal and his contractor. Although the latter is not a party to that contract, the main contract will contain a provision that certain disputes are to be determined by the engineer, whose decisions will thus be rendered binding upon him.

In making such decisions the engineer is called upon to exercise an impartial judgment, which he must do in accordance with ordinary juristic principles. He may feel that he is in a difficulty, being torn between allegiance to his principal and fairness to the contractor; this will be particularly so where the dispute is, in fact, between the contractor and himself. In reality there should be no difficulty. The engineer, in his judicial capacity, is not liable to his principal under the contract; nor can he be held to have been negligent in the exercise of his judgment. He is in the position of an arbitrator, in that he is bound to exercise his judgment without fear or favour, and it is of no consequence that he is not an arbitrator in the strict sense of that term.

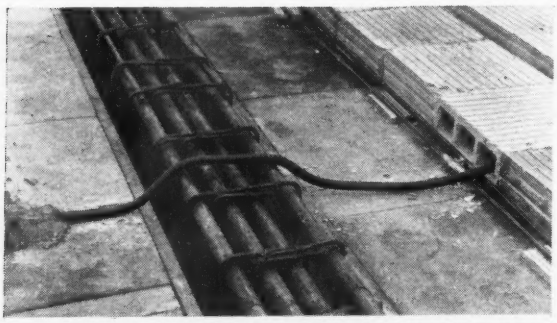
In practice, it may be difficult to decide on occasion whether the engineer was acting as his principal's agent or as an arbitrator. That is a matter to be resolved by the particular facts of the case. If the contract gives the engineer a discretion as to acceptance or rejection, or allows him to fix or vary prices, such discretion can only be exercised judicially; but the issue of a certificate of payment is not a judicial act.

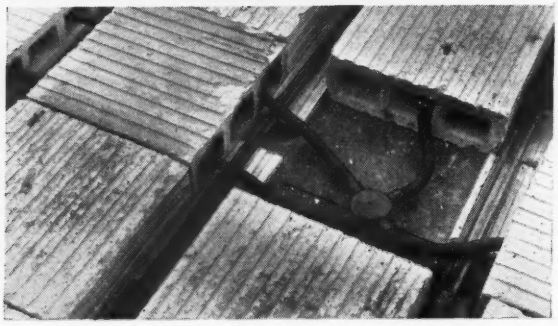
§ Jenkins *v.* Bétham (1855).

Flexible Conduit Installation

REPRESENTATIVES of the Southern Electricity Board, local electrical contractors and wholesalers, at the invitation of Clang, Ltd., of Cricklewood, recently attended at the Bitterne Park Hotel, Southampton, to hear a talk on " Clangduit " flexible conduit by Mr. F. A. Borchardt, technical adviser of Clang, Ltd. The opportunity was also taken to visit a building site at Portswood, served by the Southern Electricity Board, where a two-storey building to be used as a showroom, stores and offices by a local firm of building contractors is in course of erection.

Illustrating the flexibility of " Clangduit " when laid over mild steel reinforcing bars and, below, a typical four way conduit box connection





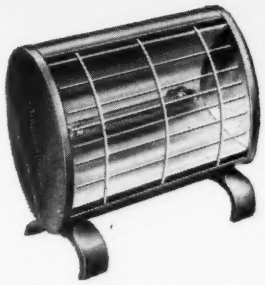
As an experiment " Clangduit " is being installed in place of normal steel conduit and examples of its use could clearly be seen owing to the unfinished state of the building. Due to its flexibility it was proved to be suitable for dropping down between cavity walls to switch and meter positions, and elbows and bends were dispensed with. The ease with which cables could be drawn through was demonstrated and where a bend occurred it was noted that this did not affect the cross sectional diameter of " Clangduit." It was not necessary to ensure that it was laid at a gradient to facilitate the draining of any water due to condensation, because of its composition. It is constructed of two layers of impregnated paper interleaved with aluminium foil and bonded together with a synthetic thermoplastic compound, externally finished with a bitumastic material. This binding makes it waterproof and also increases its mechanical and electrical properties.

In installing " Clangduit " no bending tools are required and it can be self-threaded on to any existing couplings or boxes. Although not intended to actually replace conduit, the saving in labour costs and speed of installation, and its lightness (it being only one-tenth the weight of steel) provide a useful contribution in the saving of man-hours involved in work of this kind. Earthing is necessary, but the overall economy in installation costs justifies the use of a separate earthing wire.

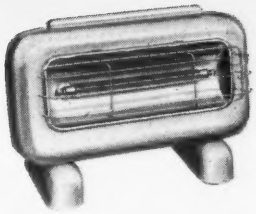
After inspecting the site, the party returned to the hotel, where Mr. Borchardt and Mr. Alex H. Brown, of Bitterne Park, Southampton, the electrical contractor responsible for the installation, answered a number of questions.

" Ironmonger " Directory

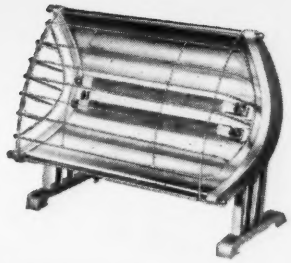
THE fourth edition of " *The Ironmonger* Directory of Branded Hardware," just published by Morgan Bros. (Publishers), Ltd., 28, Essex Street, Strand, London, W.C.2, is the largest yet issued. Its 488 pages include, in alphabetical order, some 26,000 trade marks and brand names with the names and addresses of the manufacturers or suppliers. A numerical list is devoted to the products of manufacturers who use numbers instead of brand names. The products of no fewer than 6,600 firms are represented. Copies of the directory are sent free of charge to subscribers of *The Ironmonger* (additional copies, price 6s).



GUARDIAN. 2000 *W. Bronze, Chromium plated reflector,* £6.0.0, *plus* £2.3.10 *Purchase Tax*



JEWEL. 1000 *W. Green or Cream,* £1.17.6, *plus* 13*s.* 9*d. Purchase Tax*



PARAGLOW. 1000 *W. Bronze or Cream,* £2.5.0, *plus* 16*s.* 5*d. Purchase Tax.* 2000 *W. Bronze or Cream,* £2.15.0, *plus* £1.0.1 *Purchase Tax*

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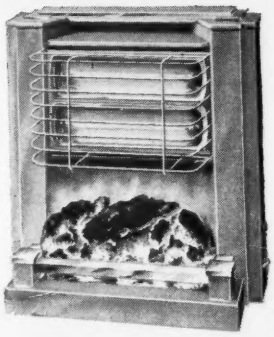
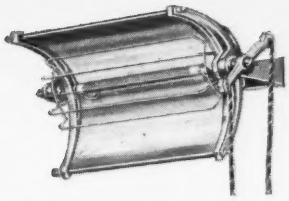
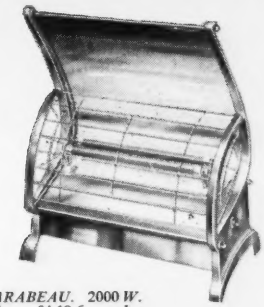


CARLTON. Imitation coal effect 2000 *W Silver, Gold or Copper,* £12.0.0, *plus* £4.7.0 *Purchase Tax*



PARABAIN. Wall fire, 1000 *W, Ivory* £3.9.6, *plus* £1.5.5 *Purchase Tax*



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Patents in 1953

Comptroller-General's Report Indicates the Trend of Invention

By S. T. MADELEY

THE Report of the Comptroller-General of Patents for the year 1953 shows, as regards the trend of invention, that particular attention has been paid to the production of non-metallic material which can be magnetized perpendicularly to the plane of a sheet of the material and has permanent magnetic properties. For electric computers magnetic "memory storage" devices have been produced, as have also devices for the magnetic recording of electric signals in general, including the use of such signals for controlling machine tools. All-electronic telephone exchanges have been developed and also cathode-ray tubes and systems for colour television.

Telephone exchanges are grouped for abridgment purposes in class 40 (iv), colour television in class 40 (iii), cathode-ray tubes in class 39 (i), and "memory storage" devices and magnetic recording devices in classes 106 (i and iv).

Of the 36,401 applications during 1953 as compared with 33,142 for 1952, the numbers of acceptances in "electric" classes are as indicated, the figures for 1953 being given first, those for 1952 second, preceded by the class in parentheses:—(35) Dynamo-electric machines, etc., 151–211; (36) electricity, conducting, etc., 94–121; (37) electricity, measuring, etc., 291–312; (38i) electric couplings, 169–174; (38ii) electric current, converting, etc., 125–181; (38iii) electric motor control systems, etc., 70–110; (38iv) electric supply systems, etc., 251–310; (38v) electric switches, etc., 258–385; (39i) electronic discharges or vapours, tubes, etc., 344–502; (39ii) electric lamps, incandescent, 34–42; (39iii) heating by electricity, 104–151; (39iv) nucleonics 13–4; (40i) electric signalling systems, etc., 112–169; (40iii) telegraphy and television, 202–260; (40v) radio systems and sets 123–205; (40vi) electronic discharge tube circuits 139–194; (40vii) radio navigation, radiolocation and aerials, 91–137; (41) electrolysis, 66–87; (53) galvanic batteries, 50–71; and (104iii) electric railways, 5–4.

As regards applications of foreign origin, the United States of America, as usual, tops the list with 5,255 (as against 4,642 for 1952). Germany sent 3,180 as against 2,980 for 1952. Of the British Commonwealth, Australia comes first with 206 compared with 143 for 1952.

Shortage of Examining Staff

The Comptroller-General has three Assistant Comptrollers and an examining staff of 342 for patents. The fees for patents amounted to £799,264 as against £789,206 in the previous year, and the bill for salaries, wages, etc., amounted to £785,505. It is still difficult to obtain recruits for the examining staff, owing of course to the better financial prospects for suitable people outside the Patent Office. In consequence of the shortage of staff it has not been possible to reduce the formidable arrears of unexamined complete specifications, although the Office has managed to prevent a substantial increase in arrears. The Ministry of Works has now really got down to the question of rebuilding and repair of the war damaged part of the Patent Office main building.

The Patent Office Library was used by 85,330 readers compared with 85,410 in 1952 and a total of 6,880 volumes has been added to the library, which now contains 93,000. Incidentally, visitors from abroad comment very favourably on the way the Patent Office Library is run compared with similar institutions in foreign countries. Since the Patent Office Library was opened in 1855 it has been used by 8,000,000 readers. The improvement in waiting accommodation made during the year has been much appreciated by those who use the library constantly.

The cases in which the Comptroller has been requested to provide certified copies of specifications for use in connection with applications filed abroad to support priority of date based on United Kingdom applications have numbered 14,380, an increase of 2,637 on 1952. This shows that inventions born in this country are being well protected abroad.

Opposed Applications

Hearings were appointed with regard to 218 cases for patents under examination, formal decisions being given in 36 cases. An interesting case under Section 9 was decided, namely that of 662,169 (Ministry of Supply). There were a number of examples given in the specification of which it was alleged that some were potential infringements. The invention related to magnetic means for detecting cracks or flaws in ferro-magnetic cylinders. This case was dealt with on opposition.

There were 266 oppositions entered under Section 14 of the Act. Ninety-five inventors were mentioned as inventors in the relevant patent.

There was only one fresh application for direction under Section 17 (5) as to the manner in which the patent application in question should be proceeded with. Of the seven requests under Section 26 of the Act for grant of a patent of addition instead of an independent patent, six were allowed. Under Section 27, 68 applications (against 83 in 1952) were made for restoration of patents that had lapsed through failure to pay renewal fee.

Only one application was made under Section 28 for an order to seal a patent that had not been sealed within the permissible time and this was refused. Amendment of application for patent after acceptance under Rule 95 (2) was allowed in six cases. Amendment of specifications under Section 29 by leave of the Comptroller was applied for in 131 cases and allowed in 58. Two applications were made to amend by leave of the Court under Section 30.

Forty-one applications were made to revoke patents under Section 33. Five offers were accepted for surrender of patent under Section 34. Patents were endorsed "Licences of Right" under Section 35 in 466 cases.

In all there are 2,096 patents in force which have been prolonged beyond the normal period. In addition to the above under the various Sections there are many cases pending, some held over from last year, or under appeal. Mention has not been made of numbers of refusals of application. The above numbers have been given merely to show how the Act is operating.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 8th September from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

18. Venner Electronics, Ltd.—Marking buoys. 2nd April, 1951. (715112.)

6099. General Electric Co., Ltd., Price, W. A., and Waldram, J. M.—Lanterns for high-pressure metal vapour lamps. 12th March, 1951. (715113.)

11477. Ferranti, Ltd.—Devices for feeding flexible sheet material. 8th May, 1951. (715013.)

14485. Electric & Musical Industries, Ltd. —Electron-discharge tube arrangements. 11th June, 1951. (715262.)

31182. Dussek Bros. & Co., Ltd., Thompson, A. W., and Bennett, G. E.—Electric cables and condensers. 19th September, 1951. (715193.)

1951

716. Western Electric Co., Inc.—Methods of treating semi-conductive bodies with electric discharges and devices utilizing such bodies. 10th January, 1951. (715268.)

2452/3. Metropolitan-Vickers Electrical Co., Ltd.—Construction of electric relays. 16th January, 1952. (715023/4.)

3976. British Thomson-Houston Co., Ltd. —Control and power regulation for lift motors and the like. 5th February, 1952. (715117.)

8354. Electric & Musical Industries, Ltd.— Circuit arrangements embodying electronic storage tubes. 4th April, 1952. (714924.)

10350. General Electric Co., Ltd.— Methods of providing a particle coating on a surface. 28th March, 1952. (715033.)

11712. British Electrical & Allied Industries Research Association.—Electric circuit interrupters having arc-extinguishing arrangements. 23rd April, 1952. (715121.)

14119. Schöttle, R. (trading as Schöttle Kommandit-Ges.).—Suction cleaners and floor polishers. 14th June, 1951. (714928.)

16732. Marconi's Wireless Telegraph Co., Ltd.—Automatic signal limiting arrangements for television receivers. 25th March, 1952. (714930.)

19813. Sangamo Weston, Ltd.—Dynamo-electric machines, more particularly arrangements for mechanically screening the windings thereof. 20th August, 1952. (715277.)

21751. Holophane, Ltd. (Holophane Co., Inc.).—Light transmitters and diffusers. 17th September, 1951. (715047.) 21753. Lighting fixtures and refractors for use therein. 17th September, 1951. (715279.)

22063. Telephone Manufacturing Co., Ltd. —Magneto-electric generators. 21st July, 1952. (715129.)

22288. Compagnie Francais Thomson-Houston.—Electric pulse code modulation communication system. 24th September, 1951. (715130.)

22299. British Thomson-Houston Co., Ltd. —Electrical insulating materials. 24th September, 1951. (715049.)

23746. Hunt (Capacitors), Ltd., A. H.— Electrical circuits and circuit components. 10th October, 1952. (715207.)

25435. Licentia Patent-Verwaltungs. Ges. —Carrier electrodes for dry-plate rectifiers, particularly for selenium dry-plate rectifiers. 31st October, 1951. (714935.)

26114. British Insulated Callender's Cables, Ltd.—Electric contact devices having means for clamping together contact pieces. 6th November, 1952. (715056.)

27851. Electric & Musical Industries, Ltd. —Cathode-ray tube apparatus. 26th November, 1952. (715061.)

28536. Koppers Ges., H.—Apparatus for heating or superheating fluent media using the heating effect of electrical currents. 5th December, 1951. (715139.)

29720. Egyesult Izzolampa es Villamossagi R. T.—Cathodes and method of making them. 19th December, 1951. (715284.)

30452. Warren, S. F. (Aircraft-Marine Products, Inc.).—Machine for applying electrical connectors to electrical elements. 31st December, 1951. (715068.)

1952

50. British Thomson-Houston Co., Ltd.— Liquid-break electric circuit breakers. 1st January, 1952. (715069.)

1770. Aircraft-Marine Products, Inc.— Electrical connector and connector strips and method and machine for applying such connectors to electrical leads. 22nd January, 1952. (715074.)

2122. General Electric Co., Ltd., and Brabham, H. B. S.—Television broadcast receivers. 21st January, 1953. (715216.)

2753/4. English Electric Co., Ltd.—Control systems for d.c. motors. 30th January, 1953. (715148/9.)

4153. Rheinpreussen Akt.-Ges. für Bergbau und Chemie.—Telephone cables. 15th February, 1952. (715087.)

4359. Illinois Institute of Technology, Armour Research Foundation of.—Electromagnetic transducer head. 19th February, 1952. (714947.)

4740. Express Lift Co., Ltd., and Billington, J. H.—Hand-winding mechanism for electric lifts and the like. 2nd February, 1953. (714948.)

5389. General Electric Co., Ltd., Friedlander, E. S., and Gallizia, E.—Rectifier arrangements. 9th February, 1953. (715090.)

5428. Smith, A. F.—Method for the continuous manufacture of polyvinyl chloride. 29th February, 1952. (715220.)

5485. Aircraft-Marine Products, Inc.— Application for electrical connectors and the like. 3rd March, 1952. (715091.)

7121. Associated Electrical Industries, Ltd. —Electrical pulse generating circuits. 19th March, 1953. (715289.)

7991. English Electric Co., Ltd.—Electric cookers and electric heating apparatus therefor. 27th March, 1953. (715095.)

8587. Yoshida, T.—Process for chromium electro-deposition. 3rd April, 1952. (715225.)

8822. Westinghouse Brake & Signal Co., Ltd., and Walker, A. H. B.—Voltage regulating apparatus of the electronic type. 11th February, 1953. (714958.)

8857. Dowty Equipment, Ltd.—Electromagnetic coils. 7th April, 1953. (715226.)

9655. Neale, J.—Low-loss tuned circuits employing reactance valves. 10th June, 1953. (715158.)

9692. Philips Electrical Industries, Ltd.— Clamping devices intended for the electrical connection of a work-coil for the inductive heating of work-pieces to the secondary winding of the output coil of a high-frequency generator. 17th April, 1952. (715227.)

10096. Bernardin, A.—Voltage regulator arrangements. 22nd April, 1952. (714961.)

10478. General Electric Co., Ltd., Fisher, S. F., and Ward, P. W.—Methods of widening electric pulses and apparatus for effecting such widening. 27th April, 1953. (715296.)

12025. Siemens & Halske Akt.-Ges.— Transmitting arrangements, particularly for television purposes. 12th May, 1952. (715164.)

12102. Telephone Manufacturing Co., Ltd. —Magneto-electric generators. 13th May, 1953. (715165.)

12720. Philips Electrical Industries, Ltd.— Semi-conductive material. 20th May, 1952. (714965.)

13453. Bendix Aviation Corporation.— Control of electric motor-generators. 27th May, 1952. (714970.)

13813. Rauland Corporation. — Cathode-ray tubes. 30th May, 1952. (715235.)

15086. British Thomson-Houston Co., Ltd. —Dielectric heating apparatus. 16th June, 1952. (715171.)

15755. Westinghouse Electric International Co.—Electric control systems for maintaining registration of a moving web of material. 23rd June, 1952. (714971.)

17719. General Electric Co.—Thermal insulation. 14th July, 1952. (715174.) 17857. Insulating materials. 15th July, 1952. (715175.)

19563. Metropolitan-Vickers Electrical Co., Ltd.—Turning gear for steam turbines. 11th August, 1953. (715300.)

20024. British Thomson-Houston Co., Ltd. —Electric rectifiers. 25th June, 1953. (714976.)

20532. Westinghouse Electric International Co.—Gas break electric circuit interrupters having arc shoots. 15th August, 1952. (714979.)

20806. Metropolitan-Vickers Electrical Co., Ltd.—Apparatus for investigating the magnetic properties of specimen cores of annular or other closed form. 29th June, 1953. (714980.)

22566. Electromecanique Soc. Anon.— Apparatus for the measurement of the effective values of secondary currents in electric resistance welding machines. 8th September, 1952. (714985.)

22945. Western Electric Co., Inc.—Electric signal translating systems employing transistors. 12th September, 1952. (714986.)

23142. British Insulated Callender's Cables, Ltd.—Protective coverings for electric cables, pipes and like elongated articles. 15th September, 1953. (714987.)

31286. General Electric Co.—Refrigerator evaporator defrosting arrangements. 10th December, 1952. (715002.)

31438. Bendix Aviation Corporation.— Microwave reflector surface. 11th December, 1952. (715003.)

32156. Telefunken Ges. für Drahtlose Telegraphie.—Electric pulse multi-channel signal transmission systems. 18th December, 1952. (715006.)

32652. Marconi's Wireless Telegraph Co., Ltd.—Remotely controllable variable frequency oscillators. 26th August, 1953. (715190.)

32827. Tesla, Narodni Podnik.—Control and safety device for thyratron rectifiers. 29th December, 1952. (715308.)

32912. Sylvania Electric Products, Inc.— Apparatus for orienting lead-in wires of electric lamps and like electrical devices. 29th December, 1952. (715009.)

33013. Soc. d'Appareils de Controle et d'Equipement des Moteurs (S.A.C.E.M.).— Electrostatic machines working by influence, in particular in rotary machines producing a periodical discharge. 30th December, 1952. (715010.)

Dairy Equipment Test Reports

The National Institute for Research in Dairying, Shinfield, Reading, has issued test reports, price 1s post free, relating to the Hanovia water sterilizer Model 4 (Report No. 54 C/2) and the Gascoigne "Rotorfreeze" Model 6 (Report No. 54 C/3).

"Seeboard" H.P. Terms

A number of concessions in hire-purchase terms which have been introduced by the South Eastern Electricity Board were reported at last week's meeting of the Electricity Consultative Council.

Since 1st July the hire-purchase period for electric cookers has been extended from three to five years. Members of the Consultative Council welcomed this relaxation but it was felt by some that there was scope for further extension. It was pointed out that a neighbouring Board allowed seven years' hire purchase during which the repayments also included free maintenance.

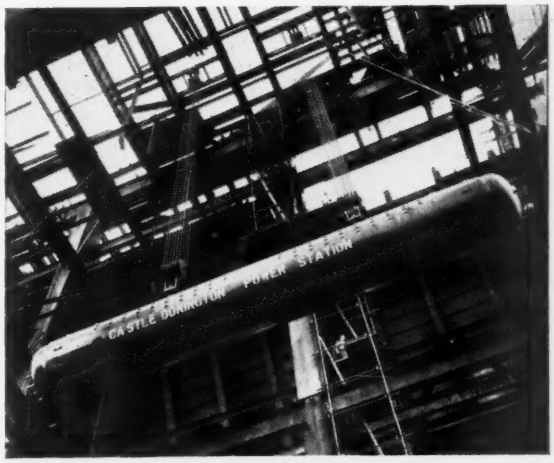
As from 14th July, following the revocation of the Hire-Purchase Control Orders, the purchase tax on all appliances has been included by the Board in the amount of the hire-purchase terms so that the deposit is now equal to a quarterly instalment. The maximum purchase period for appliances which were covered by the Orders has been increased to two years, except for refrigerators over 4 cu ft (three years). The purchase period for immersion heaters, which were not affected by the Orders, has been extended to three years, the same as for storage heaters, the purchase tax for both types being spread over the instalments.

South Wales Tariff Review

When introducing its standard tariffs in 1952 the South Wales Electricity Board stated that it would review them in the light of their operation in practice. In carrying out this review, which has now been completed, careful account has been taken of views expressed by the Consultative Council, by local authorities and other bodies, and by individual consumers. With regard to the domestic tariff, the Board recognizes that a particular difficulty arises in relation to the assessment of kitchens and sculleries and it is proposed to amend the tariff so that a scullery will not necessarily become assessable as a kitchen by the installation of a cooker. This has been the rule in the past, and has been the source of some criticism. The Board is also discussing with the Consultative Council the possibility of reducing the assessment of very large houses.

The commercial block rate tariff provides for the consumer to pay each quarter for a varying number of kWh at 5d according to the floor area of his premises. While the Board sees no grounds for amending the general provisions of this tariff, it accepts the view that this tariff creates difficulties in the case of premises such as warehouses, where there is restricted use of electricity over much of the floor area (e.g., in the warehouse itself) but relatively high consumption in a small portion (e.g., in the warehouse office). Since the whole floor area is taken into account in computing charges, it often happens that all electricity consumed in such premises is charged at 5d/kWh. To meet this difficulty it is proposed that consumers shall have the option of separating their wiring so that the supply to the office portion of the premises can be separately metered, thus enabling the consumer to enjoy the benefit of the cheap secondary rate of 0·85d for consumption in that part of the premises. A further difficulty has arisen with regard to outbuildings forming part of commercial premises. It is proposed that such outbuildings shall in future be assessable under the commercial tariff only when used for a commercial purpose. As an alternative to the floor area tariff, the consumer with a maximum demand of 20 kW or more can take his supplies under the commercial maximum demand tariff. It is considered that the m.d. tariff could, with advantage, be made available to a wider range of commercial consumers and it is therefore intended to lower the limit of availability from 20 kW to 5 kW. Implementation of this amendment will depend upon supplies of suitable m.d. meters, a problem which is the subject of discussions with the manufacturers at the present time. The industrial maximum demand tariff is to be similarly extended.

It is proposed to adopt a basic figure of 60s a ton for the coal price adjustment clause of the commercial and industrial maximum demand tariffs in place of the existing figure of 38s.



Castle Donington, in the East Midlands Division, will be the first power station in this country to have 100 MW boiler turbine units; it is eventually planned for six such sets. The photograph shows the first 830,000 lb/hr Babcock & Wilcox boiler being lifted on 22nd July

Consumers and B.E.A. Costs

When electricity tariffs have been discussed by Consultative Councils from time to time complaint has been made that there are no means whereby the consumers' views on bulk supply charges can be represented to the British Electricity Authority. At last week's meeting of the Midlands Consultative Council at Evesham it was reported that a letter had been received from the Minister of Fuel and Power saying he considered that the Council was correct in its view that an extension of consumer machinery to the Central Authority came within the terms of reference of the inquiry into the electricity industry and he was placing the matter before Sir Edward Herbert.

Progress in the North-East

At the quarterly meeting of the North Eastern Consultative Council at Newcastle-on-Tyne it was reported that during March, April and May new substations had been put into operation at 276 places, the great majority for supplying electricity to villages and farms. In addition, h.v. supplies had been given to 21 industrial and commercial consumers, and during the same period 137 miles of cables and mains had been commissioned. During the quarter, 321 agricultural premises had been supplied with electricity and agreements had been negotiated for supplying another 404 premises. Twenty-one villages, most of them in the Tyne Sub-Area, were brought on supply during the quarter. It was reported that the Electricity Board had approved estimates amounting to £1,095,386 covering supply projects involving 74 housing schemes and 249 rural supplies.

Rogerstone Power Station

The British Electricity Authority has received the consent of the Minister of Fuel and Power to the establishment of the power station at Rogerstone, Mon. The station will have two 60 MW turbo-generators each served by a boiler unit having an evaporative capacity of 550,000 lb/hr. The authorization includes the construction of two 2¼ million gallon/hr cooling towers.

New B.E.A. Collier Launched

The latest addition to the collier fleet of the British Electricity Authority, the *Sir William Walker*, was launched last week from the Sunderland shipbuilding yard of S. P. Austin & Son, Ltd. Sir William Walker, J.P., was present at the launch and the naming ceremony was performed by his daughter, Mrs. J. D. Peattie. Others present at the ceremony included Mr. V. A. Pask, Mr. A. Haywood and Mr. E. Long (British Electricity Authority).

The vessel is 340ft in overall length and will carry a total deadweight of about 3,700 tons with a service speed of 11 knots. Comfortable accommodation is arranged for all members of the crew in single berth cabins, while there is a laundry aft fitted with a power operated washing machine and wringer, ironing board, electric iron, clothes rail and airing cupboard. The *Sir William Walker* will be fitted with radar and echo-sounding equipment. Propelling machinery will be installed aft in the vessel by the North Eastern Marine Engineering Co., Ltd. Mr. N. S. Rowstron (Stephenson Clarke, Ltd.) is superintending construction of the vessel on behalf of the owners.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—BRISBANE.—17th September. City Council. 33,000 V and 11,000 V submarine and underground cables. (E.S.B. 17690/54. Ten/10010.)*

Downpatrick.—3rd August. U.D.C. Electrical installations for eighty houses. T. M'Lean, Council architect, Irish Street.

Formosa.—TAIPEI.—18th August. Central Trust of China. 175 h.p. 3,300 V electric motor. (E.S.B. 17661/54. Ten/10003.)* 18th August. Electrical mining equipment. (E.S.B. 17610/54. Ten/10004.)*

India.—NEW DELHI.—6th August. Director General of Supplies and Disposals. Underground telephone cable. (E.S.B. 17643/54. Ten/9999.)*

Iraq.—BAGDAD.—1st September. Ministry of Finance. Radio equipment for the Directorate General of Police. (E.S.B. 17687/54. Ten/10016).*

London.—STEPNEY.—23rd August. Borough Council. Electrical installation work in block of flats and six maisonnettes. (See this issue.)

Londonderry.—11th August. Borough Education Authority. Electrical installation in primary school. A. T. Marshall, architect, Princes Quay.

New Zealand.—WELLINGTON.—7th September. Post and Telegraph Department. Electric fans and heaters. (E.S.B. 17679/54. Ten/10014.)*

Persia.—TEHRAN.—19th August. Procurement Office, Joint Fund for Technical and Economic Development. Wires and cables and accessories for aerials. (E.S.B. 15909/54. Ten/10030.)*

Portuguese East Africa.—BEIRA.—16th August. Posts, Railways and Transport Department, Beira Railways. Electrical material for a transformer at Beira Port. (E.S.B. 17752/54. Ten/10006.)*

Portuguese West Africa.—17th September. Directorate General of Overseas Development. Overhead travelling cranes and conveyors. (E.S.B. 17979/54. Ten/10042.)*

South Africa.—JOHANNESBURG.—11th August. Stores Department, South African Railways. 100 cable end boxes. (E.S.B. 17620/54. Ten/9997.)* 12th August. Electric cable. (E.S.B. 17651/54. Ten/9996.)* 19th August. Electrically driven wooden slat package elevating conveyor. (E.S.B. 17629/54. Ten/9994.)*

CAPE TOWN.—13th August. Provincial Administration, Cape of Good Hope. Kitchen equipment comprising electric range and boiling pans at Frere Hospital, East London. (E.S.B. 17618/54. Ten/10008.)*

Sunderland.—5th August. Education Committee. Electrical installations in three new classrooms at Monkwearmouth Grammar School and two at Fordhall Special School. Borough engineer, 27, Fawcett Street.

ORDERS PLACED

Blackpool.—Corporation Highways Committee. Further to the note which appeared in our last issue, we are now informed that the contract for 1,000 chokes and capacitors has been awarded to F. G. Ryde & Co., Ltd., whose quotation was £2,641.

Kendal.—Corporation. Electrical installations in 54 dwellings to be erected on the Hall Garth estate (£1,382).—L. Barker.

London.—L.C.C. Electrical installation at Royal Hill primary school, Greenwich (£2,628).—Buchanan & Curwen, Ltd.

Mitcham.—Corporation. Street lighting for Robinson Road, Lewis Road, Links Road and Sherwood Park Road (£2,383).—Harland & Wolff, Ltd.

Newcastle-on-Tyne.—Regional Hospital Board. Electrical installations for additions to St. Nicholas's Hospital, Gosforth (£28,811).—Blackburn & Starling, Ltd.

Stoke-on-Trent.—City Council. Installations of fluorescent street lighting in Stafford Street, Miles Bank and Fountain Square, Hanley, and in Wedgwood Street and Swan Square, Burslem (£2,251).—Revo Electric Co., Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alnwick.—Bus station (£10,000); U.D.C. surveyor.

Birkenhead.—Extensions to police headquarters; Willink & Dod, architects, Cunard Buildings, Liverpool.

Bolton.—Extensions to Springfield Mills; J. W. Marshall & Co., Ltd., papermakers.

Bridgwater.—Erection of Hamp Secondary Modern School; Burrough & Hannam, architects, 17, Orchard Street, Bristol.

Brighton.—School, Hollingbury estate, and flats, Norwich Drive, Lower Bevendean (18), Carden Hill and Woodbourne Avenue (14), Chelwood Close (48), Birdham Road and Moulsecombe Way (20), and Hollingdean estate (24); borough engineer and surveyor, 26–30, King's Road, Brighton, 1.

Clutton.—Houses (50) at Timsbury, for R.D.C.; Thomas & Morgan & Partners, 23, Gelliwasted Road, Pontypridd.

Congleton.—Houses (58), Buglawton estate; J. T. Yearsley, Parnelscroft, Park Lane.

Cradley.—Factory, Park Lane; Wombourn Manufacturing Co., Ltd., Commando Works, Wombourn.

Croydon.—Factory, Addington estate; S. D. Chapman, Ltd., 418, Limpsfield Road, Warlingham.

Ealing.—Baths and wash-houses, South Ealing Road; borough engineer.

Eston.—Houses (40); U.D.C. surveyor, South Bank-on-Tees.

Felling (Co. Durham).—Shopping centre on the Leam Lane housing estate for Ravenseft Properties, Ltd., 52, Charles Street, Berkeley Square, London, W.1.

Gateshead.—Warehouse and offices, Hawks Road, for H. J. Heinz & Co.; Mauchlen & Weightman, architects, 12, Saville Row, Newcastle-on-Tyne.

Hemel Hempstead.—Factory and offices; Roto-Finish, Ltd., 39, Park Street, London, W.1.

Hereford.—Workshop block for fire station, St. Owen Street; Nicol, Nicol & Thomas, architects, 111, New Street, Birmingham.

Hull.—Central police station and offices, Queen's Gardens; Priestman & Lazenby, architects, 101, Spring Bank.

Flats (72), Porter Street; J. Mather & Son, Ltd., builders, 64a, De Grey Street.

Liverpool.—Secondary grammar school for girls, Allerton; H. Thearle, architect, 6, Rodney Street.

London.—BERMONDSEY.—Flats (32), Barnham Road; Stock, Page & Stock, architects, Fanshaw House, Fanshaw Street, N.1.

Luton.—Factory, Selbourne Road; R.F.C., Ltd., 59, Chapel Street.

Maidstone.—Development of Park Wood estate for houses, shopping centres, school and light industries; borough surveyor, Palace Avenue.

Morecambe.—Houses (46), off Corringham Road; Modern Homes (Morecambe), Ltd., 5, Tarnbrook Road, Lancaster.

Newcastle-on-Tyne.—Factory at Fawdon, Newcastle, for Scott & Turner, Ltd., health salt manufacturers, Gallowgate, Newcastle; Cackett, Burns Dick & McKellar, 21, Ellison Place, Newcastle.

Additions to "C" block at Newcastle General Hospital for the Regional Hospital Board (£66,000); G. Bainbridge, builder, 205, Westgate Road.

Brush factory in Blandford Street for Securos, Ltd.; C. Solomon, St. Mary's Place.

Newton Aycliffe (Co. Durham).—Houses (390) for Aycliffe Development Corporation; chief architect.

Nuneaton.—Factory, Cauldwell Road; Francis & Wilebur, hosiery manufacturers, Hill Street, Hinckley.

Factory additions, Aston Road; Alfred Conner & Co., Ltd., paper boxes, Fife Street, Nuneaton.

Radcliffe.—Factory and offices, Allens Green; Sweetule Products, Ltd., Church Street.

Ripon.—Factory at Bondgate; Glovers of Ripon, Ltd., auto and agricultural engineers, Harrogate and Ripon.

Saltash.—Reconstruction of the shopping centre in Fore Street (£45,000); borough surveyor, Church House.

Scarborough.—Proposed pavilion at Wallis's Cayton Bay Holiday Camp (£34,000); E. Hunter, Ltd., builders, Beaconsfield Street, Scarborough.

Somerset.—Erection of secondary modern schools at Churchill and Williton; R. O. Harris, county architect, Park Street, Taunton.

Stockton-on-Tees.—T.A. centre, drill hall, workshops and garage, South Road, for Durham County T.A. and A.F. Association; 53, Old Elvet, Durham.

Stone.—Conversions at "The Radfords," Longton Road, to form Council offices (electrical work); U.D.C. surveyor, Town Hall, Stone, Staffs.

Stretford.—Additional storey at Trafford Park Road for Kelloggs, Ltd.; Wm. Thornton, Ltd., Liverpool.

Sunderland.—New primary schools at Castle View and Farringdon and technical school at Moorlands; borough architect, Stockton Road.

Wakefield.—Extensions to works at Stafford Terrace for Bradley & Craven, Ltd.; Kay & Hartley, architects, 4, Crown Court, Wakefield.

Wallsend.—Multi-storey flats, Ropery Lane; borough surveyor.

Warrington.—Factory, Arpley; Unilever, Ltd., Port Sunlight.

Warwickshire.—Permanent health clinics, including flats for district nurses on large housing estates, for County Health Committee; G. R. Barnsley, county architect, Shire Hall, Warwick.

Wood Green.—Rebuilding St. Andrew's Church, Alexandra Park Road; R. S. Morris, architect, 1a, Beaumont Street, London, W.1.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

In East Africa as in Great Britain

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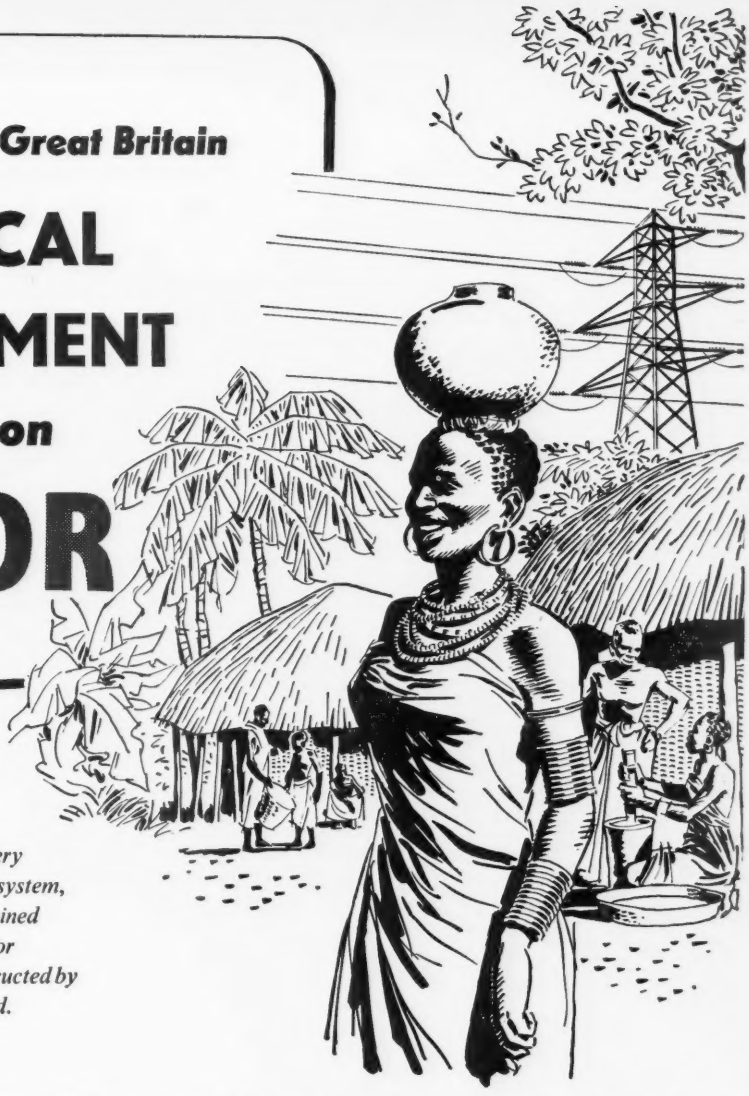

The East African Power and Lighting Company Limited have incorporated a number of Tudor Battery equipments in their electricity supply system, including a 110-volt battery and combined charging rectifier/D.C. switchboard for Wanjii Power Station, recently constructed by Balfour, Beatty and Company Limited.

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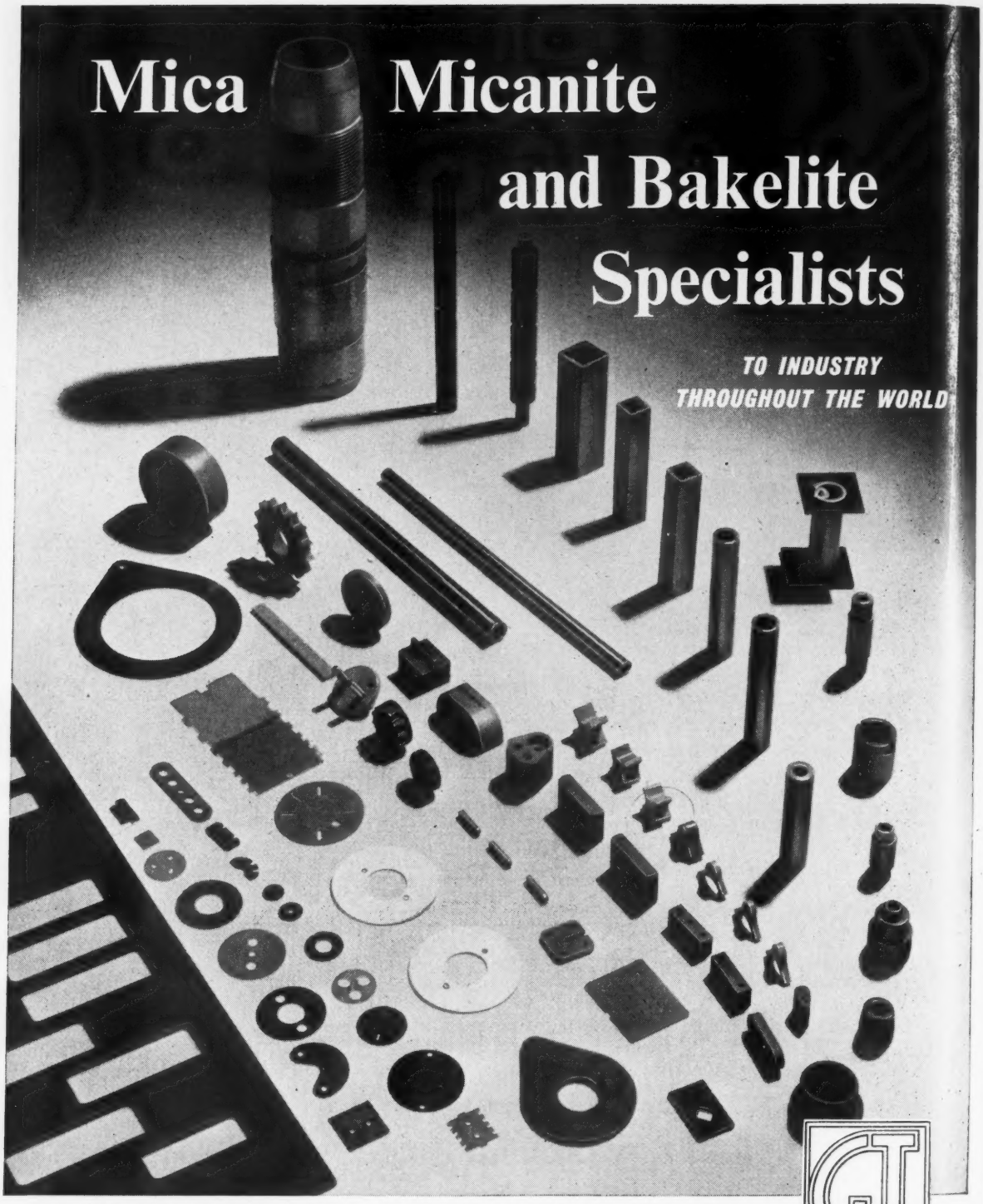

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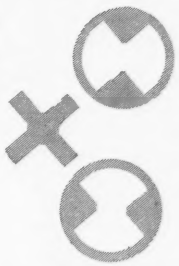

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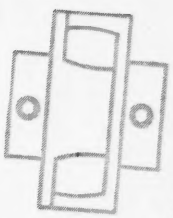

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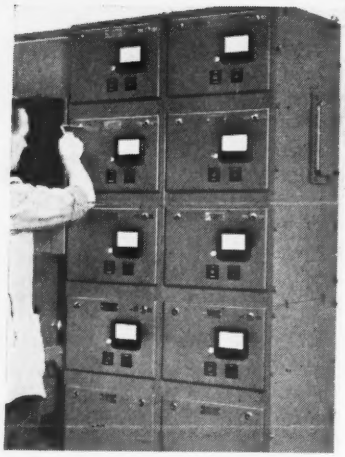

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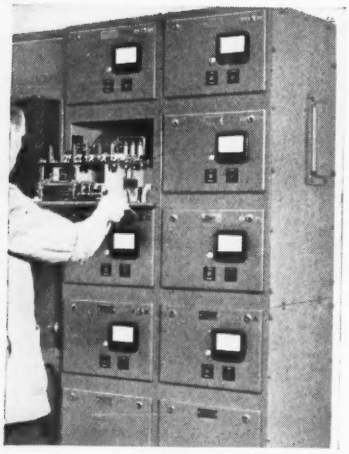

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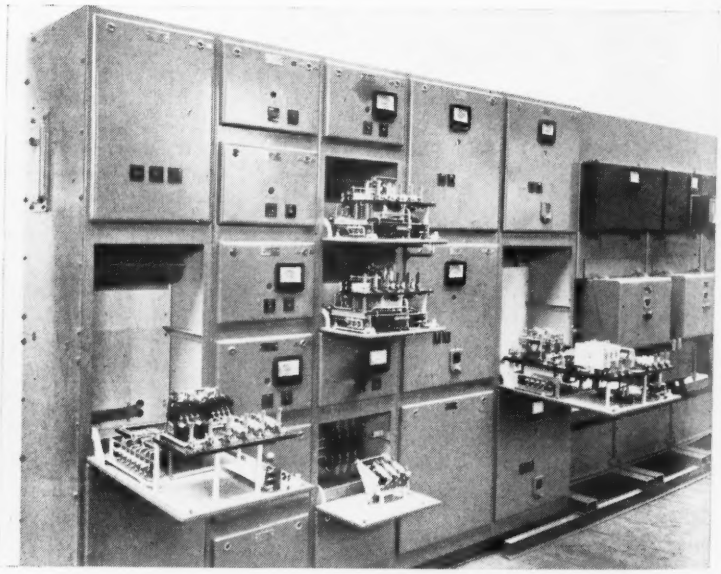

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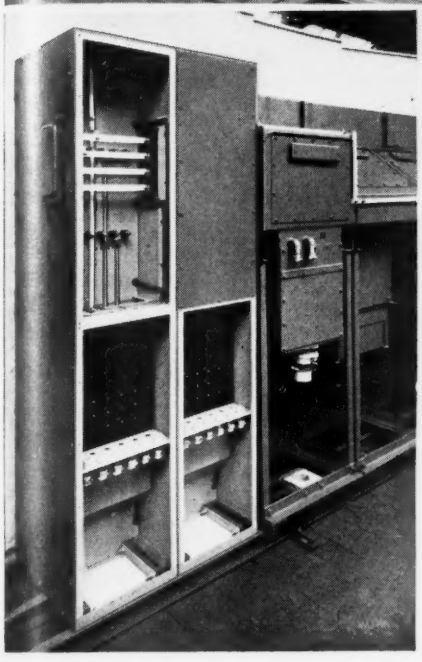

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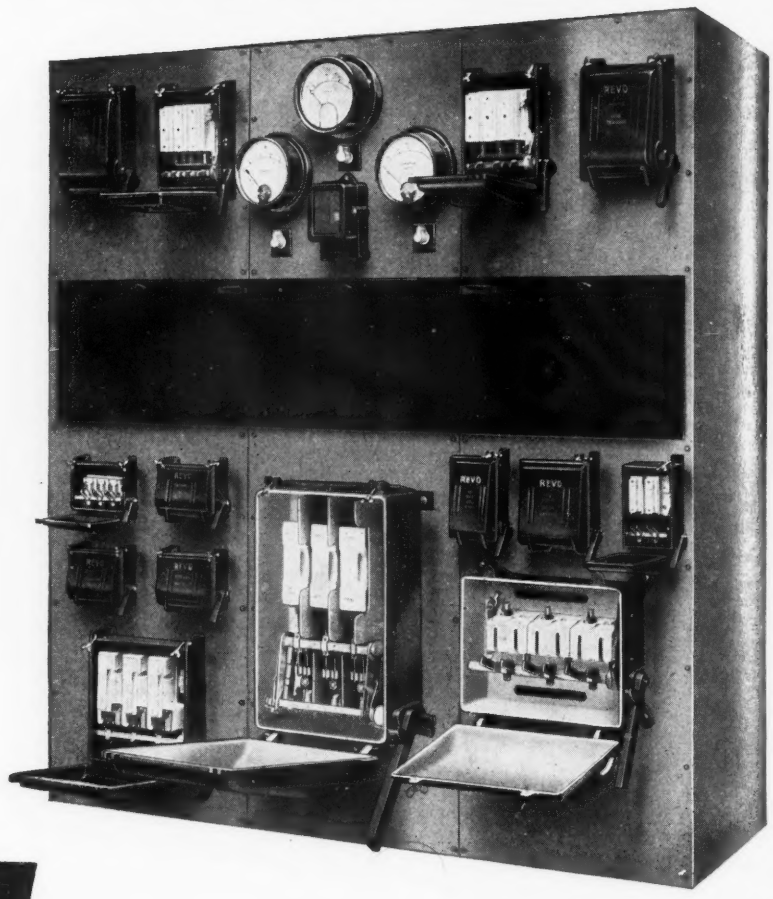

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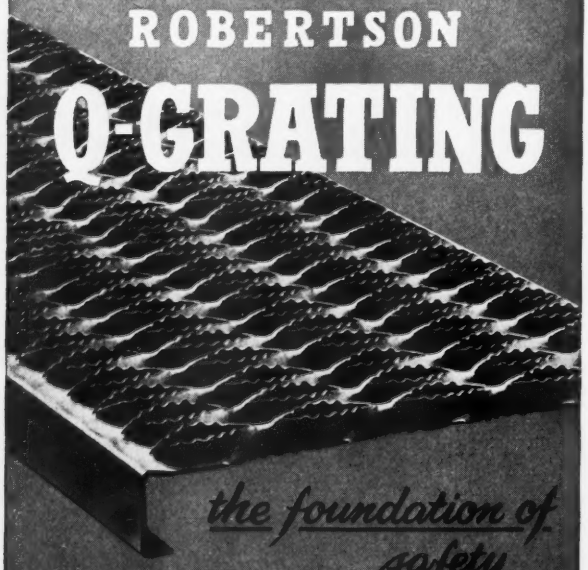

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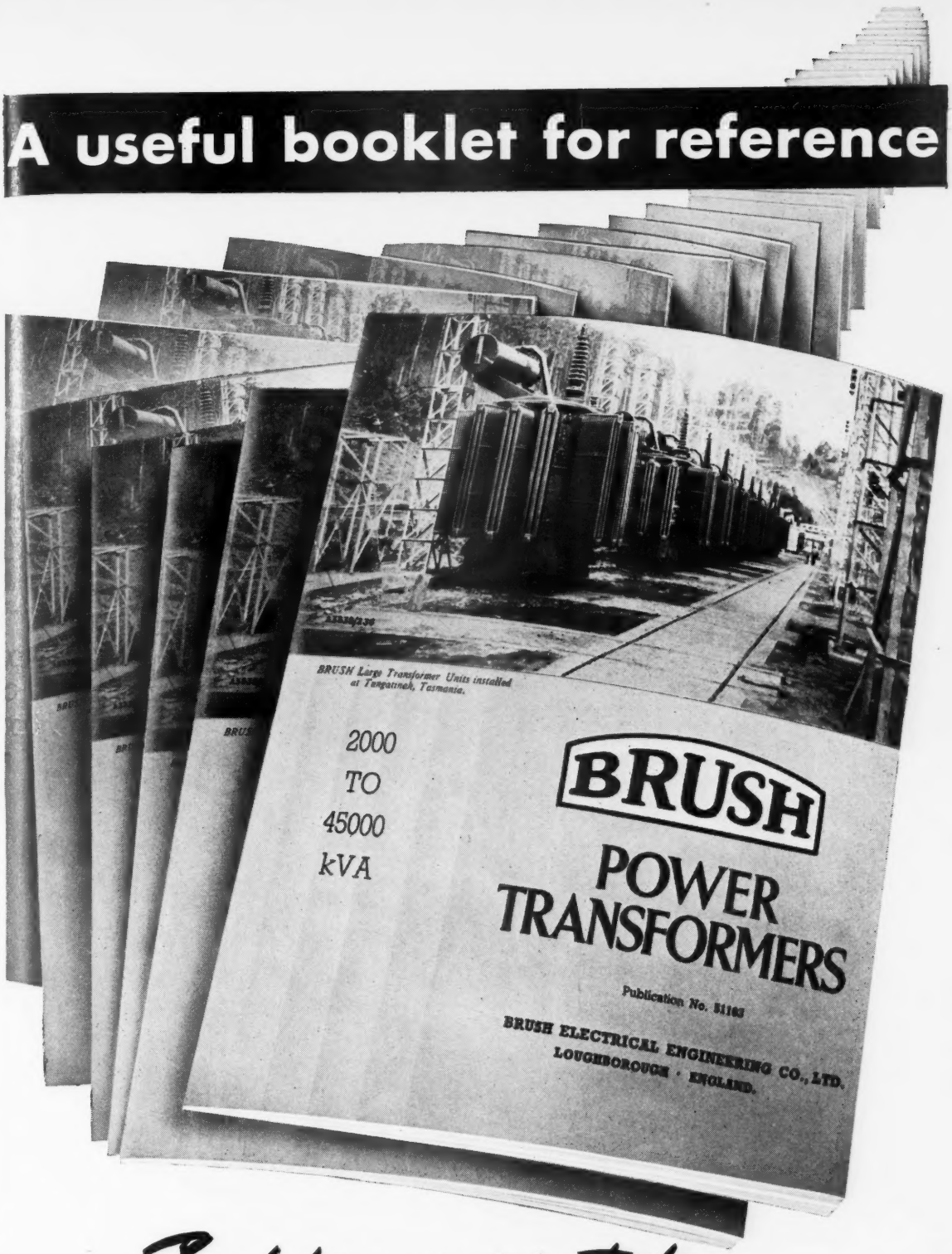

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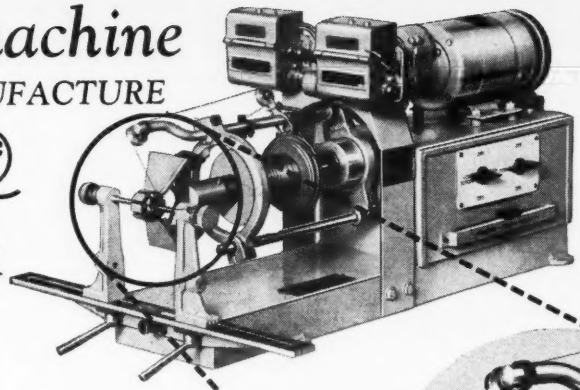
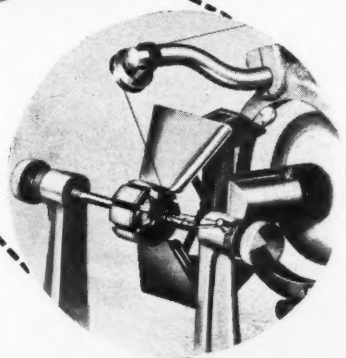


WE will wind your sample armatures for approval without obligation. Details of all production requirements should be submitted to our Technical Department to ensure satisfactory application. Reasonable deliveries of all models.



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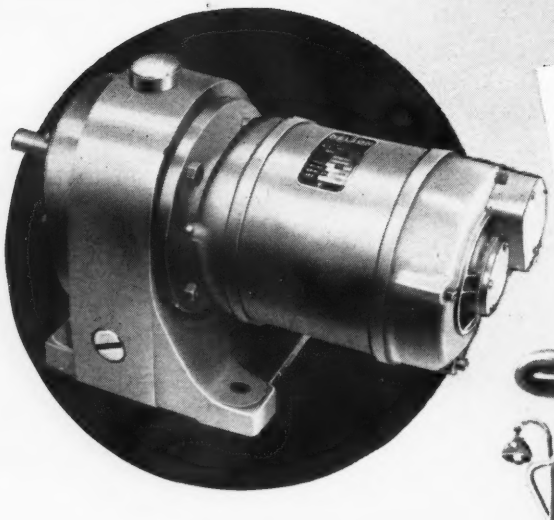

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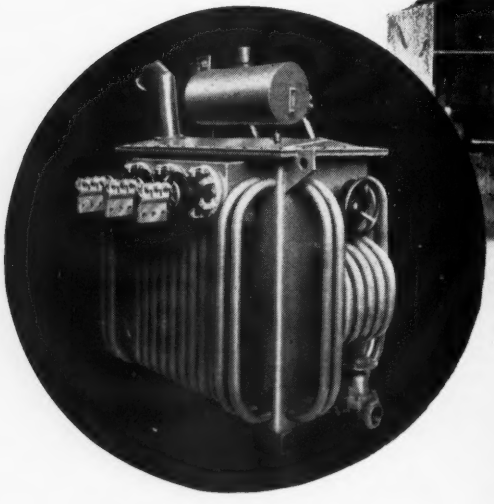

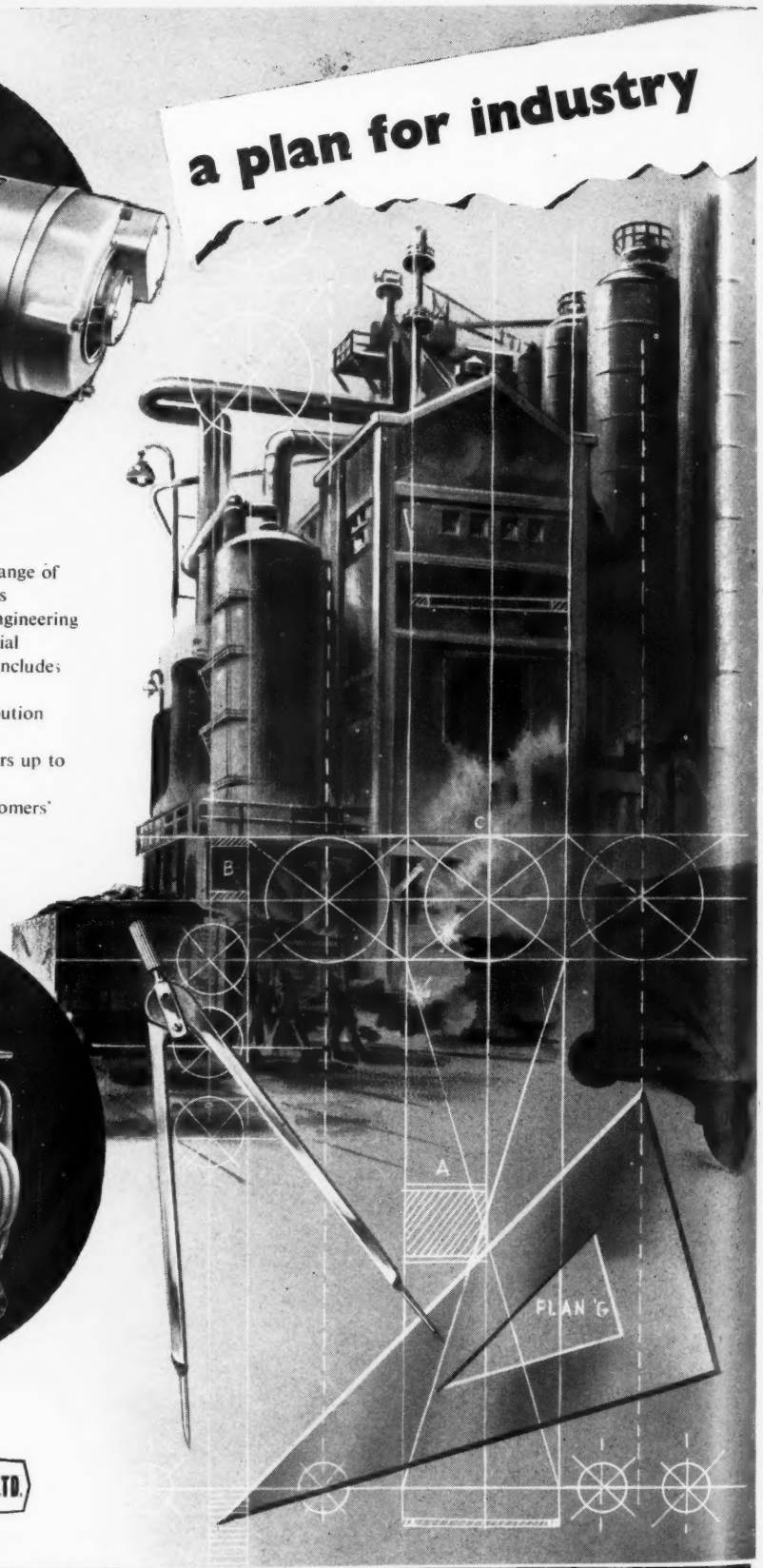

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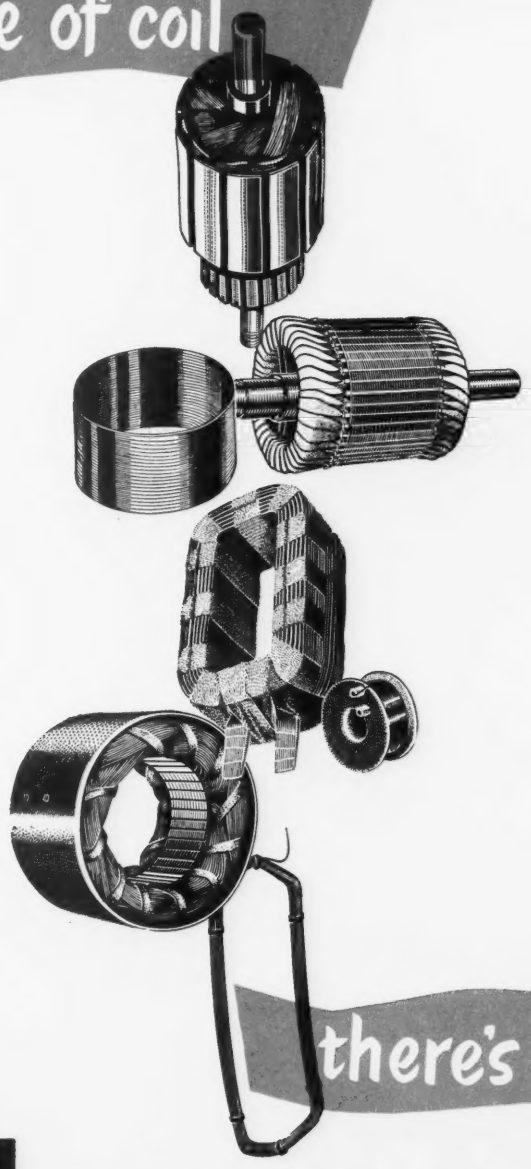

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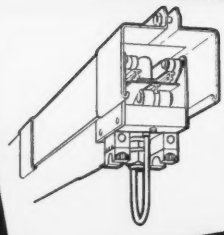

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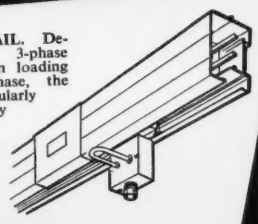
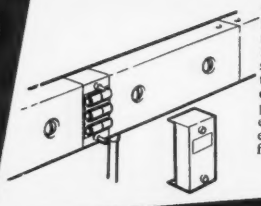


for industrial power users



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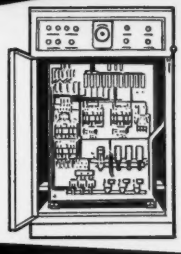

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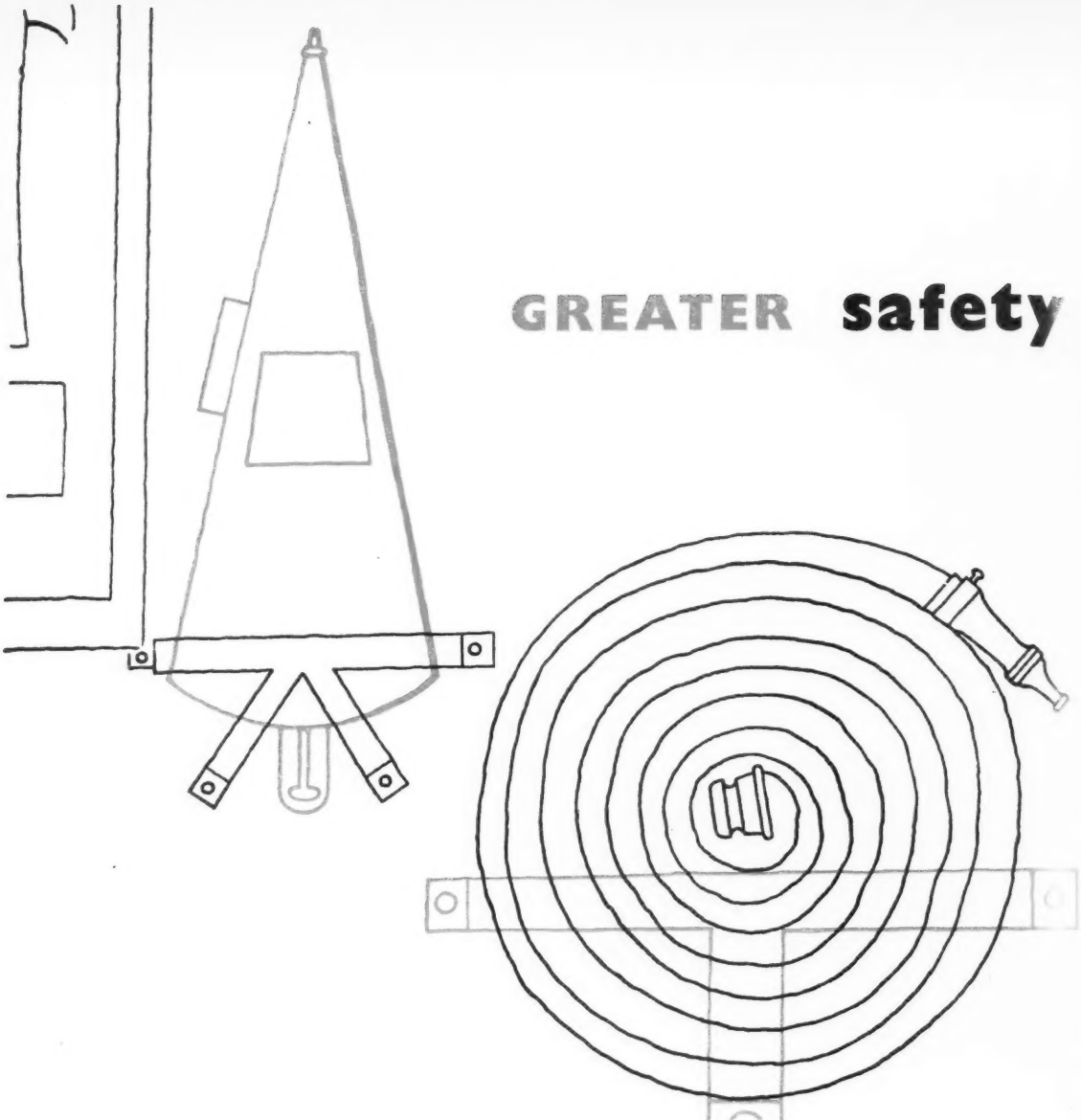

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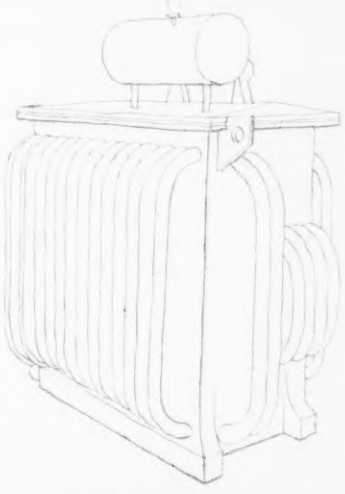

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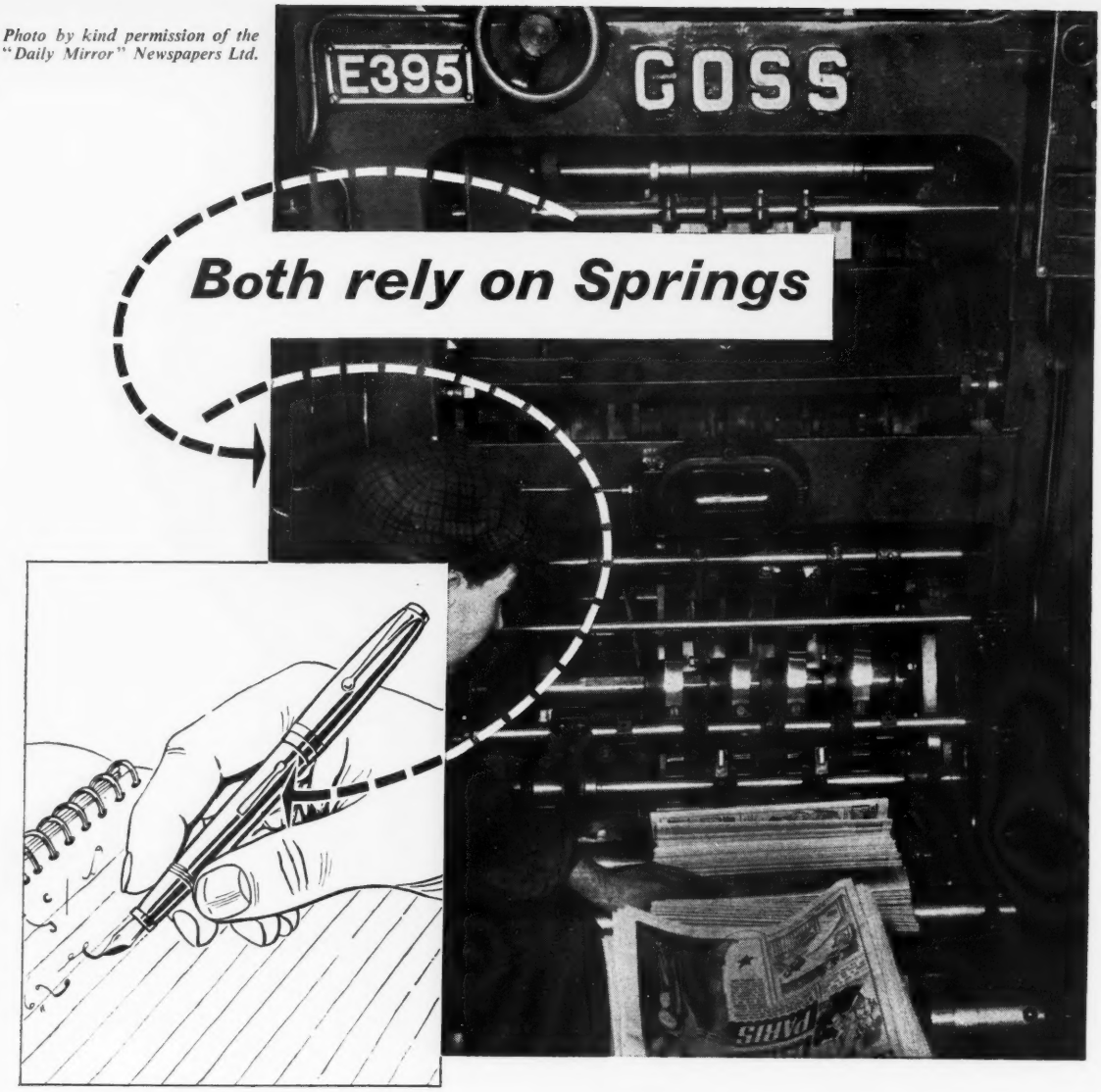

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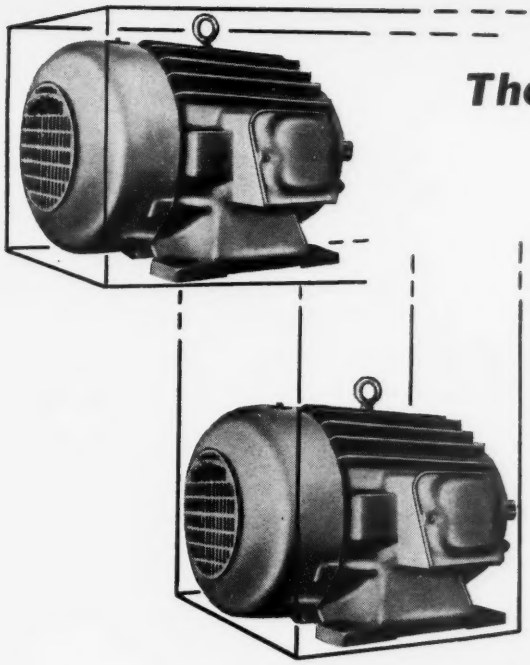

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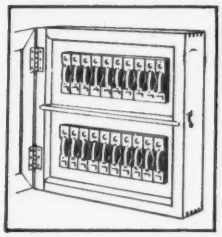

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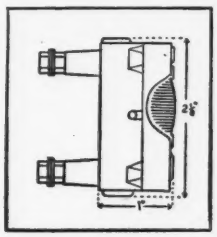

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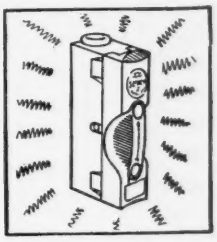

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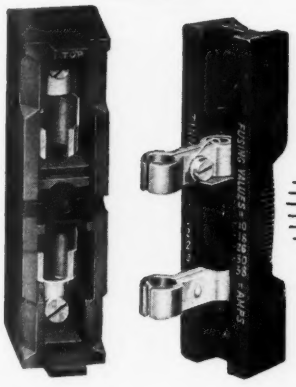

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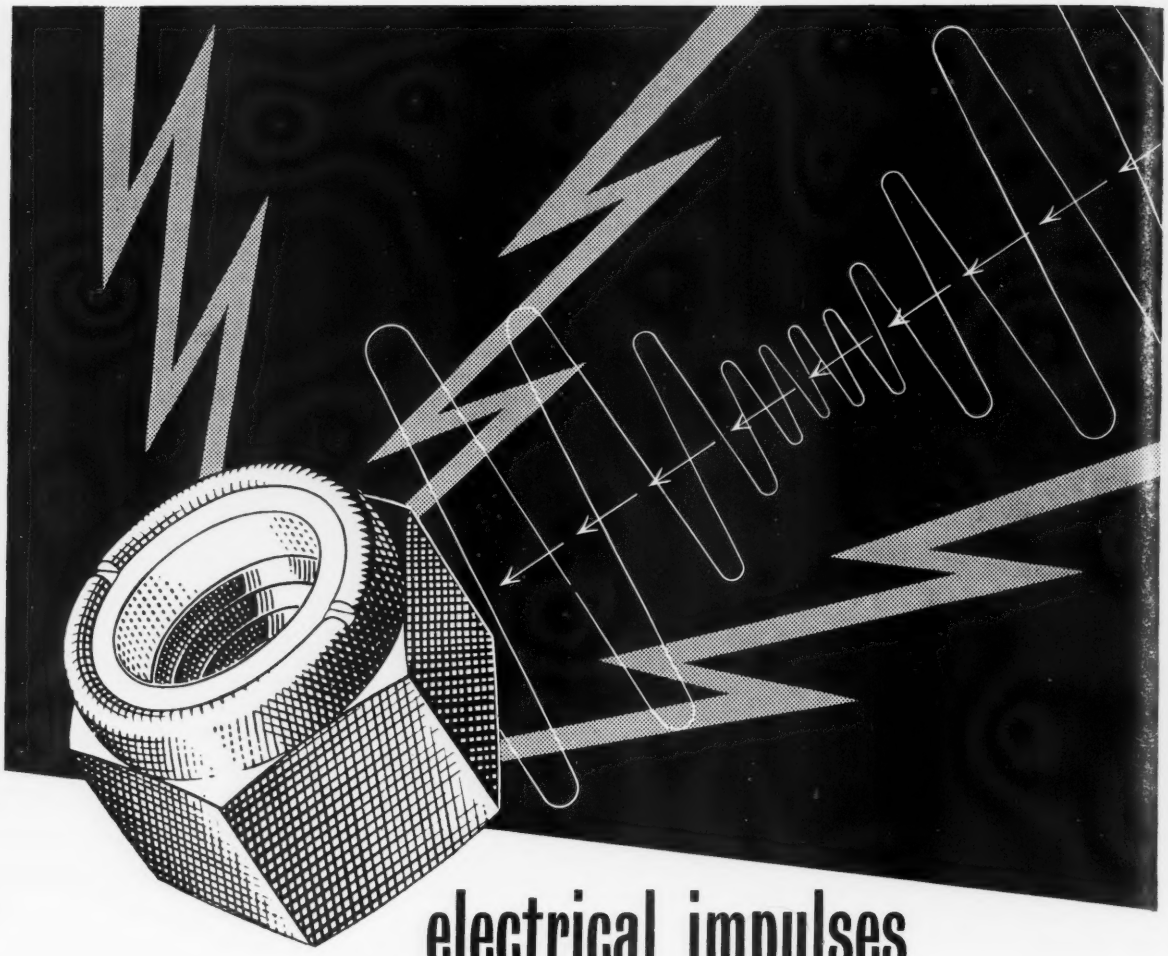


electrical impulses give any ordinary nut quite a turn . . .

But not the Nyloc. Fix it on any piece of electrical equipment and it stays fixed. It can be used over and over again, no matter how many times the equipment is dismantled and reassembled. The Nyloc behaves in the same tenacious way when subjected to mechanical vibration, sudden temperature changes, tensioning or immersion in oily liquids. Thread irregularities don't affect it in the least. The secret's in the nylon insert which moulds itself round the bolt thread and keeps the nut locked tight until *you* decide to remove it.

Anywhere a nut works loose you need a Simmonds self-locking nut. It may be a Nyloc, or a Fibre Nut with fibre insert, or a Pinnacle Nut with metal diaphragm. We'll be glad to tell you which is best for your particular job.

. . . but nothing rattles the NYLOC

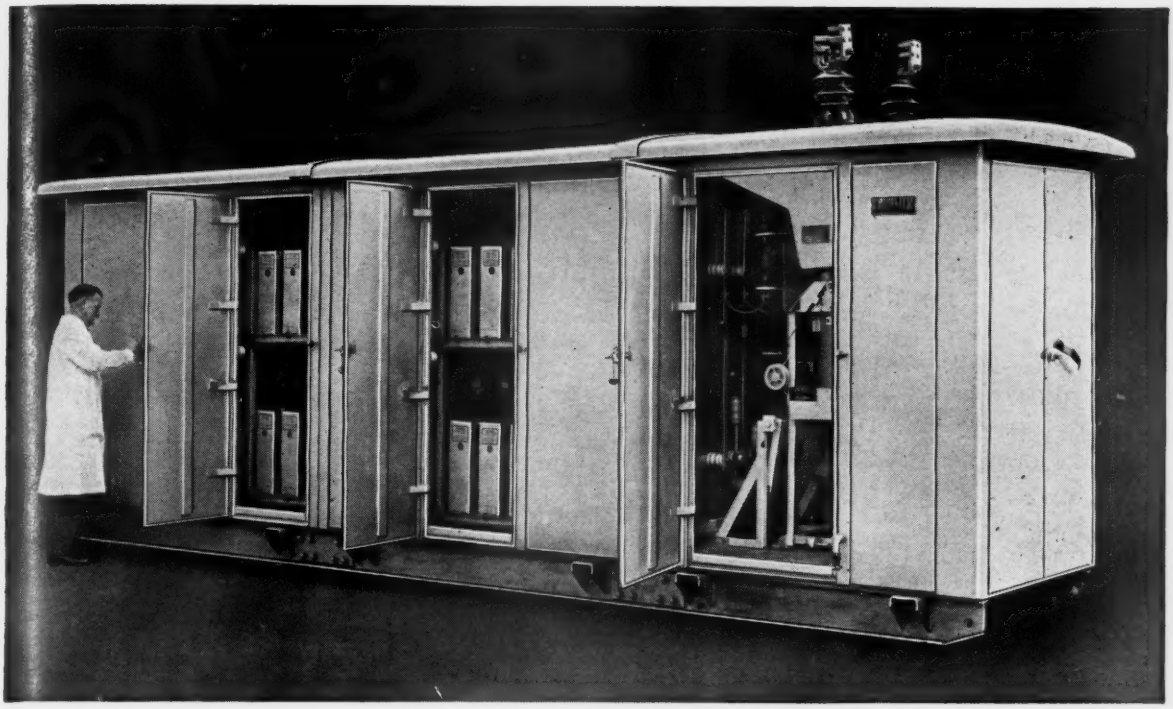
SIMMONDS AEROCESSORIES LIMITED, TREFOREST, PONTYPRIDD, GLAMORGAN.

Branches: London, Birmingham, Stockholm, Copenhagen, Melbourne, Sydney, Amsterdam and Milan

A MEMBER OF THE FIRTH CLEVELAND GROUP

CRC 10N

3000 kVAr in one housing



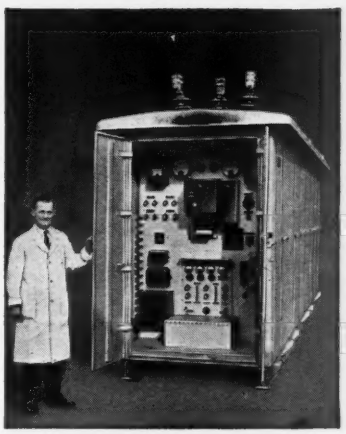
DUBILIER AUTOMATIC CAPACITOR BANKS FOR EXPORT

WE illustrate one of the four large high tension Banks recently completed for the Shell Company in Venezuela. They are the largest Capacitor Banks, complete in their housings, that have been built in this country.

The combined rated ouput is 4.5 MVAr, but they have been designed so that by adding further capacitor units to each housing this can be increased to 12 MVAr without altering the switch and control gear. The units are standard Dubilier high voltage type PFH Capacitors, which comprise a number of conservatively rated oil-impregnated paper dielectric capacitor sections arranged in series-parallel connections to suit the rated voltage of the capacitor unit. All these sections are constructed with extended foils which assist the cooling of the dielectric in the sections. Air circulation for cooling is provided by automatic fans which come into operation when the Capacitors are switched into circuit.

The switch, automatic control and protective equipment (see right) is mounted on a separate panel accessible through the doors at the end of the housing.

In addition to these large capacitors, we also manufacture Power Factor Correction Capacitors suitable for your factory. Our engineers are at your service to advise you whether the installation of Dubilier capacitors would be to your advantage.



DUBILIER
CONDENSER CO. (1925) LTD.

DUCON WORKS, VICTORIA ROAD, NORTH ACTON, LONDON, W.3

Telephone: Acorn 2241 (5 lines) Telegrams: Hivoltcon, Wesphone London

Cables: Hivoltcon, London, Marconi International Code.

D.IO.5A

COUGHTRIE

FITTINGS

The Natural Selection

Always better than they have to be

CATALOGUE AVAILABLE ON REQUEST

MANUFACTURED AT **HILLINGTON, GLASGOW, S.W.2**

by **J. & G. COUGHTRIE Ltd.**

Now!

A 13 Amp. Fused Plug

To retail at
3/8 each.

in Resilient Rubber . . . by

SANDERS
WEDNESBURY

Makers of unbreakable Plugs since 1937

LEAFLET 152
GIVING FULL DETAILS ON REQUEST

WM. SANDERS & CO. (WEDNESBURY) LTD., WEDNESBURY, STAFFS.

The connection is obvious

H. C. ELECTROLYTIC COPPER WIRE, BARS AND STRIP

By Spencer Wire

THE SPENCER WIRE CO. LTD., THORNES WIRE MILLS, WAKEFIELD, YORKS.

The BEST

IN BRASS BAYONET HOLDERS

by Sperryn TRADE MARK

Available in all types, both normal and miniature

SPERRYN & CO. LTD., MOORSOM STREET, BIRMINGHAM 6

A NAME THAT IS WORLD WIDE

Established in 1820, our goods and therefore our name has encircled the Globe many times, and we are modestly proud of this.

Let us continue to serve you whether at home or abroad by quoting you for:

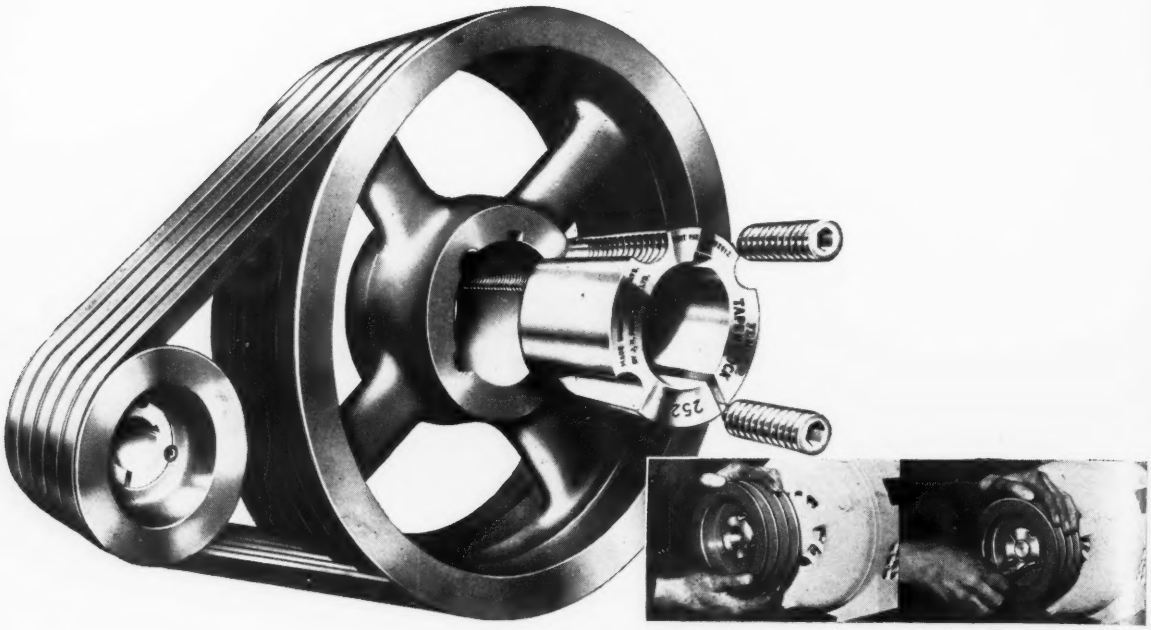
ELECTRICAL MACHINERY, SWITCH & CONTROL GEAR
LIGHTING FITTINGS, DESK & CEILING FANS

VERITYS LTD.

Sales Headquarters: BRETTENHAM HOUSE, LANCASTER PLACE, LONDON, W.C.2

Branches: BIRMINGHAM • BRISTOL • GLASGOW • LEEDS • LIVERPOOL
MANCHESTER • NEWCASTLE

success speaks for itself..



ON—slip pulley and bush on shaft, and tighten two screws. Result—secure as a shrunk-on fit.

OFF—slacken screws, put one in jacking hole, and tighten. Pulley and bush then withdraw automatically.

FENNER pulleys incorporating time saving TAPER·LOCK

Give Fastest/Simplest pulley change

and here are NEW **TAPER·LOCK** *developments*

there is only one "TAPER·LOCK"

Complete simplicity makes "Taper-Lock" the quickest and surest method of pulley mounting. Only genuine "Taper-Lock" has the patented half holes which make this possible. Send today for leaflet 300/4 with details of Stock drives up to 75 H.P. fitted with "Taper-Lock."

Fenner
POWER TRANSMISSION

NEW TAPER·LOCK WELD-ON HUBS

provide an easy means of getting "Taper-Lock" benefits on fan rotors, steel pulleys and conveyor drums. Available in 7 sizes.
Send for leaflet 360/14.

NEW TAPER·LOCK FLEXIBLE COUPLINGS

grip shaft ends like a shrunk-on fit and yet provide easy removal. Prevent damage through accidental misalignment, and cushion shock loads. Available from 3¼" to 10" dia. in 6 sizes.
Send for leaflet 350/14.

J.H. FENNER & CO LTD.

HULL, ENGLAND

beat the clock with Taper-Lock

LARGEST MANUFACTURERS OF V-BELT DRIVES IN THE COMMONWEALTH

RECORD

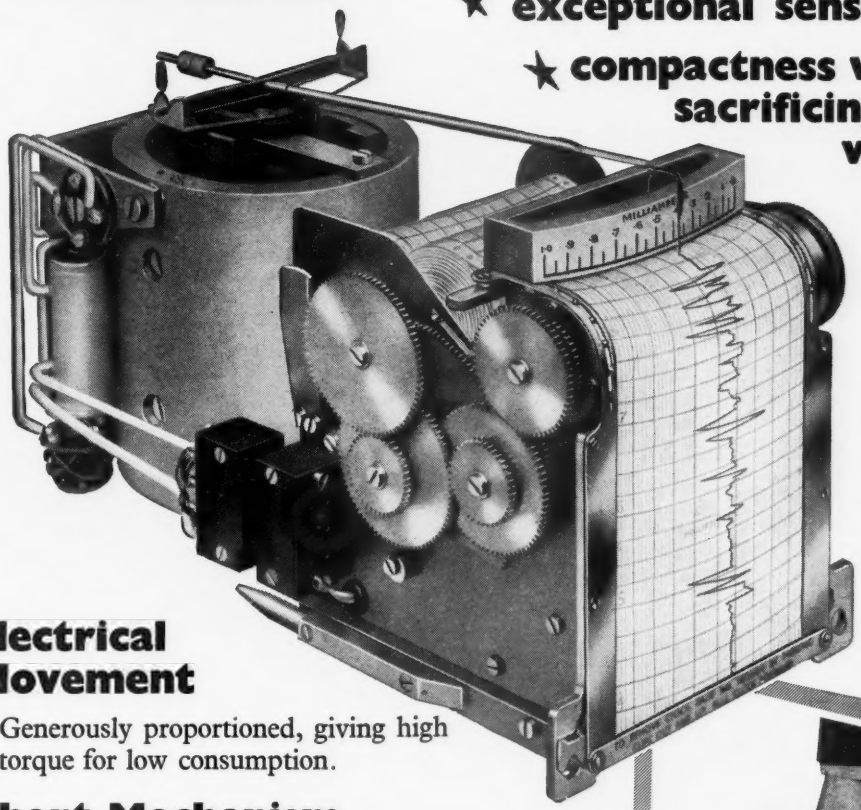
GRAPHIC RECORDER

★ for accuracy

★ speed of response

★ exceptional sensitivity

★ compactness without sacrificing chart visibility



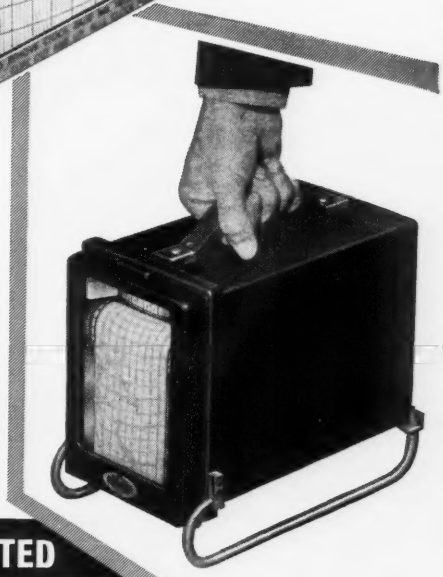
Electrical Movement

Generously proportioned, giving high torque for low consumption.

Chart Mechanism

Compact, removable without disturbing the electrical movement and can be re-loaded with ease and safety.

Available over the full range of power requirements and tachometers. Also available in special forms for telecommunication and electronic service. Standard designs for Switchboard mounting or portable work are available for quick delivery.



THE RECORD ELECTRICAL COMPANY LIMITED

BROADHEATH, ALTRINCHAM, CHESHIRE

Telephones : Altrincham 3221 (4 lines) *Telegrams and Cables:* Cirscale, Altrincham

LONDON OFFICE: 28 VICTORIA STREET, LONDON, S.W.1.

Telephones : ABBey 5148 and 2783 *Telegrams:* Cirscale, Sowest, London *Cables :* Cirscale, London

The Largest Ceiling . . .

THIS IS BELIEVED to be the largest ceiling in Great Britain combining lighting, radiant heating, ventilation, and acoustic insulation.

The high voltage cable for the wiring of the exceptionally modern lighting system in this building, the Research and Design Departments of C. A. Parsons & Co. Ltd. at Newcastle-upon-Tyne, was supplied by Enfield Cables Limited.

Over 7,000 "Osram" Cold Cathode Tubes, automatically controlled by photo-electric cells, are installed in this building, some 12 miles . . . and another 13 miles in the adjoining factory.

Enfield are proud to be associated with such an enterprise and can offer cables of the same reliability and performance for immediate delivery throughout the country.

We will be pleased to add your name to our mailing list for details of our monthly stocks of Paper Insulated Cables and Winding Wires.

ENFIELD CABLES LIMITED, VICTORIA HOUSE, SOUTHAMPTON ROW, LONDON, W.C.1

Telephone: HOLborn 9292 (London Office) · Telegrams: CABLES, ENFIELD · Telephone: HOWARD 2661 (Works)

E.39

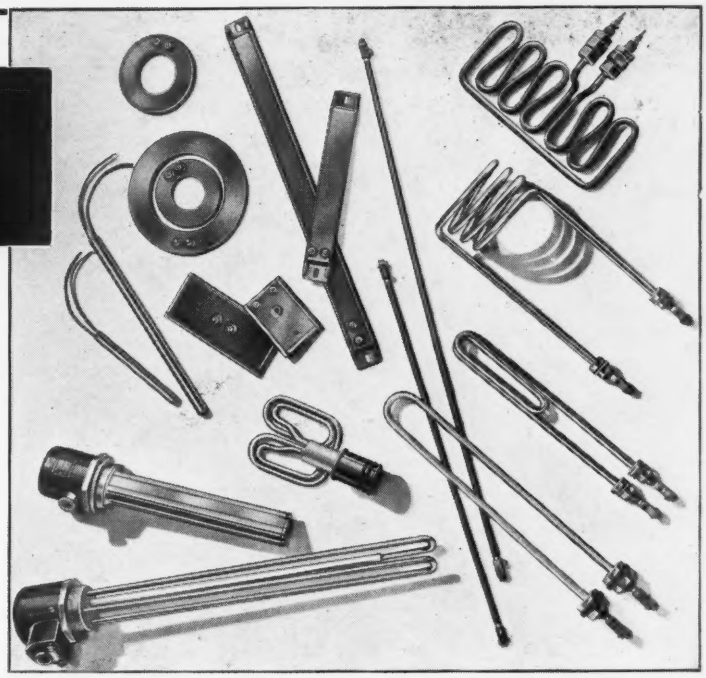
Enfield

BRAY

Refractory-embedded Metal-Clad

ELECTRICAL HEATING ELEMENTS

n Strip, Ring, Cartridge and Tubular (TUBALOX) form



GEO. BRAY AND CO. LTD. LEICESTER PLACE, LEEDS 2

Tel. Leeds 20981/9 Grams. "Bray Leeds 2"

MOTOR STARTERS

Type COBIF

D-O-L PUSH BUTTON OPERATED WITH BUILT-IN ISOLATOR AND FUSES

These air break or oil immersed starters are supplied for motors up to 7½ H.P.

Rewirable or H.R.C. cartridge pattern fuses.

For prices and details write for List 7-5

BRITISH KLOCKNER SWITCHGEAR LTD.

MEMBER OF THE DORMAN SMITH GROUP

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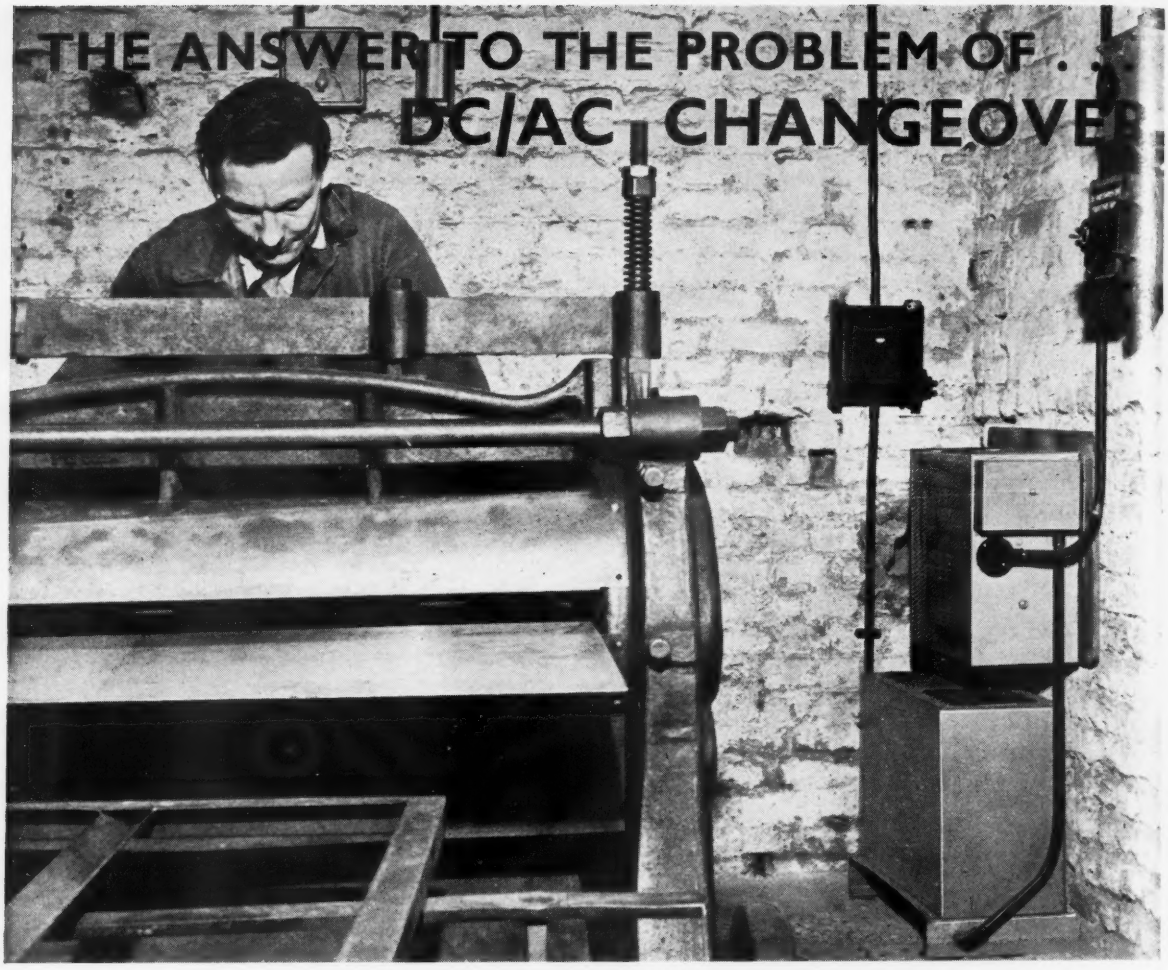
MANCHESTER: 22 BOOTH STREET 2	CENTRAL 5736
GLASGOW: 249 ST. VINCENT STREET	CENTRAL 2479
BELFAST: 11 COLLEGE SQUARE NORTH	BELFAST 24620



WESTALITE

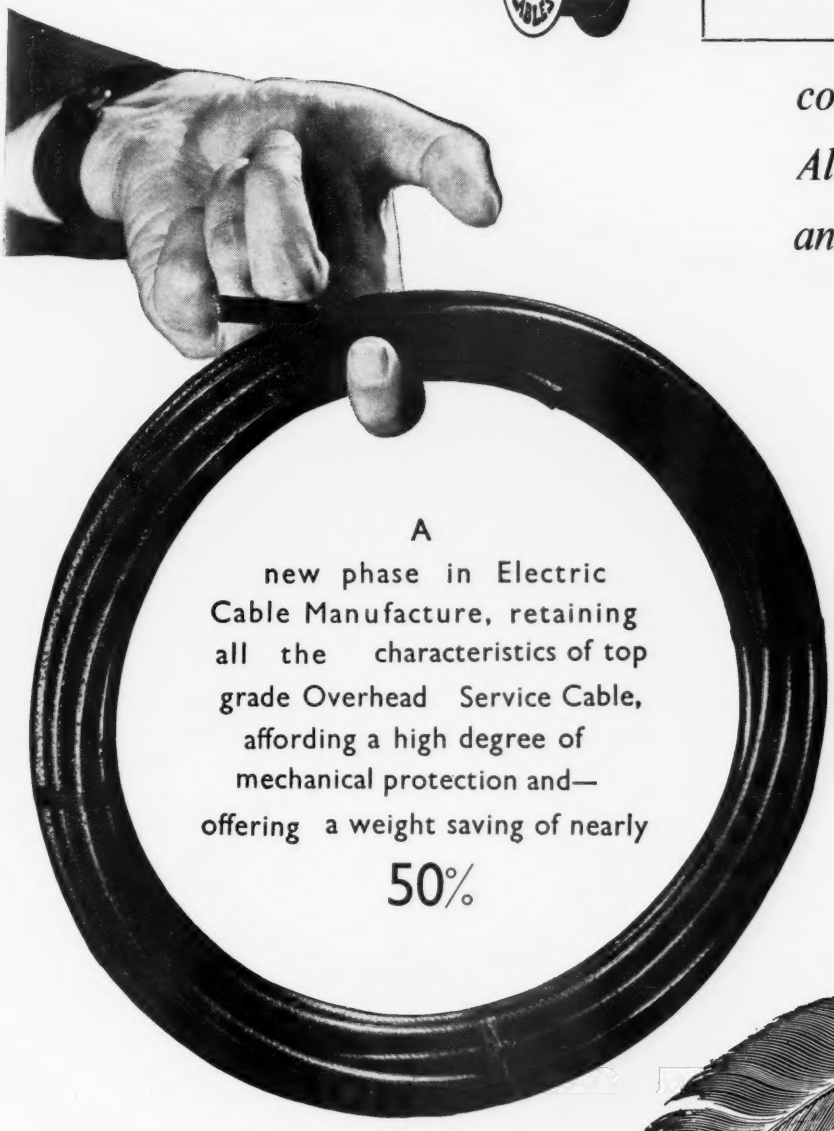
METAL RECTIFIERS

By connecting a 'Westalite' rectifier of the required output between the AC supply and existing DC equipment, no other adjustment is necessary and operations go on as usual. Westinghouse 'Westalite' rectifiers make the changeover from DC to AC mains as simple as that. The illustration above (by courtesy of Messrs. W. J. Hubbard & Sons Ltd.) is an example of such an installation, and is one of many carried out by the London Electricity Board in the South-East Area of London. Extensive ranges of single- or three-phase rectifiers for all industrial applications such as battery charging, DC motor drives, magnet excitations, etc., are now available EX STOCK. Write for full details to:

WESTINGHOUSE BRAKE & SIGNAL CO. LTD.
DEPT. E.R.13, 82 YORK WAY, KING'S CROSS, LONDON, N.1

STERLING "ALUPLAS"

combining
Aluminium
and Plastic



A
new phase in Electric
Cable Manufacture, retaining
all the characteristics of top
grade Overhead Service Cable,
affording a high degree of
mechanical protection and—
offering a weight saving of nearly
50%

ALUPLAS
Registered Trade Mark

STERLING CABLE COMPANY LIMITED

ALDERMASTON • BERKSHIRE

Telephone: Reading 1000 *Telegrams: "Sterling, Phone, Reading"*

TOUCHÉ !

"On the wrong foot again, old boy.

When will you learn . . . !"

"When I've been at it as long as you —

I might make a better showing."

" Don't sound so glum —

you've taught me one thing—

and I'm your humble servant."

"Ah! back to M. & C. Service —

my ' coup de grace '."

" Never a moment's worry! On your Guard! "

BRITAIN'S FOREMOST DISTRIBUTORS

MONKS & CRANE LTD

THE TWIST DRILL SPECIALISTS

HEAD OFFICE:

STANHOPE STREET • BIRMINGHAM 12 • *Tel: CALthorpe 1381 (5 lines)*

MANCHESTER OFFICE:
8, WILMSLOW ROAD
MANCHESTER, 14
Tel: Rusholme 6224 (3 lines)

LONDON OFFICE:
295, EUSTON ROAD
LONDON, N.W.1
Tel: EUSton 5311 (3 lines)

GLASGOW OFFICE:
79, CROWN STREET
GLASGOW, C.5
Tel: South 3313 (3 lines)

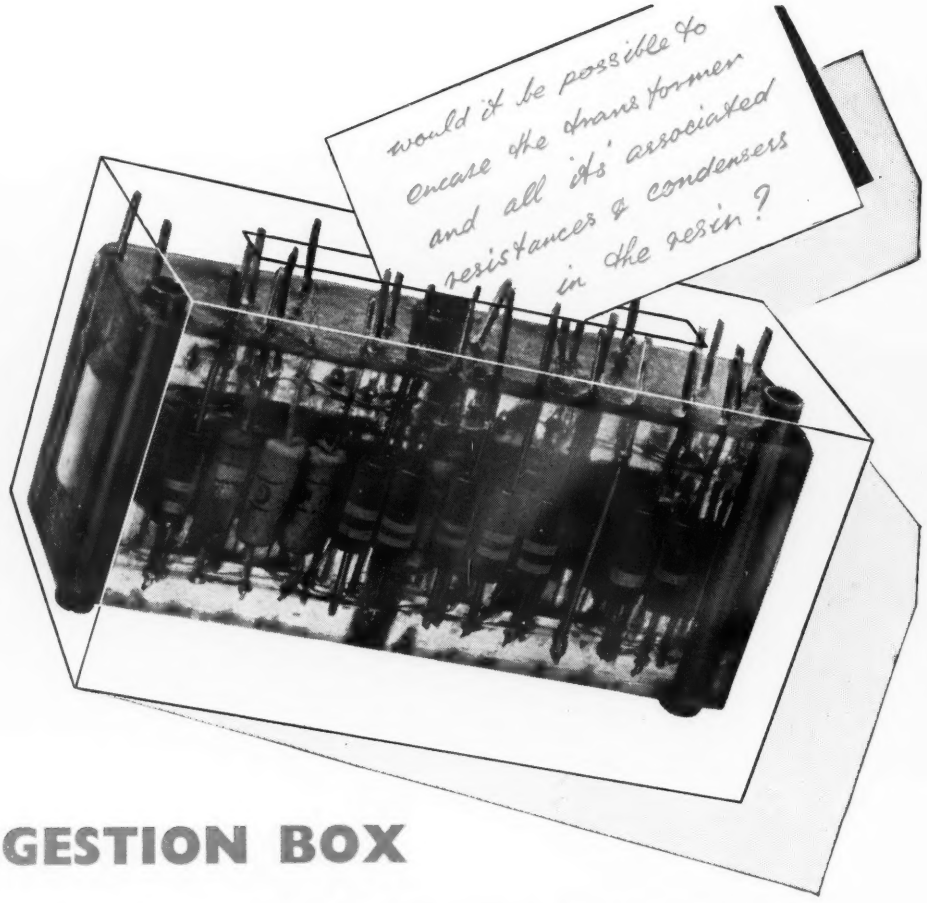
THE FUTURE OF THE *Electrical Age*

with

SANKEY LAMINATIONS

JOSEPH SANKEY & SONS LTD

BILSTON · STAFFS. *LONDON OFFICE:* 168 REGENT ST., LONDON, W.1



SUGGESTION BOX

Take a closer look at this! It may be full of suggestions for solving *your* problems. An intricate electronic circuit is embedded in BAKELITE Polyester Resin, SR.17449—the grade specially recommended for 'potting' circuits.

This resin has not only exceptionally high resistance to shock but it also protects delicate components from heat, humidity and corrosion. It is one of a group of BAKELITE Polyester Resins whose many different properties are being used in a wide range of applications.

It may be that this suggests ways in which Polyester Resins could be of service to you. If so, please 'phone or write to Bakelite Limited, who will be delighted to give you every assistance in following up new ideas.

TREFOIL

BAKELITE REGD. TRADE MARKS

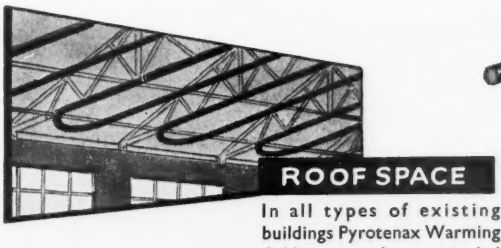
Polyester **RESINS**

BAKELITE LIMITED · 12/18 GROSVENOR GARDENS · LONDON · SW1 · Telephone: SLOane 0898

Producers of Phenolic, Urea, Alkyd & Silicone Moulding Materials · Polyester Resins · Phenolic & Urea Resins, Cements & Adhesives · Laminated Sheet, Rod & Tube · Glass Fibre & Asbestos Laminates · Rigid & Flexible PVC Sheet · PVC Moulding & Extrusion Compounds · Decorative Laminated Plastics

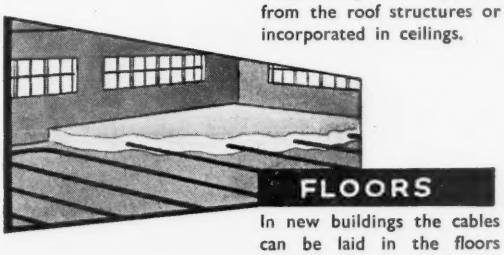
P.67

Pyrotenax M.I.* WARMING cables



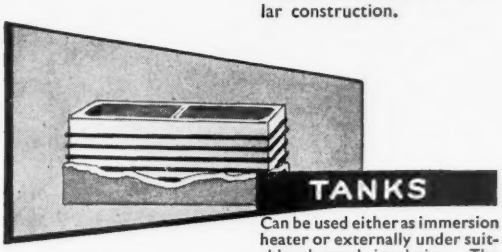
ROOF SPACE

In all types of existing buildings Pyrotenax Warming Cables may be suspended from the roof structures or incorporated in ceilings.



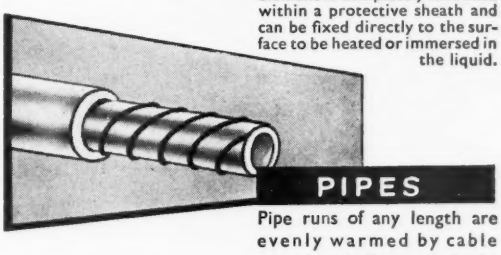
FLOORS

In new buildings the cables can be laid in the floors whether of concrete or cellular construction.



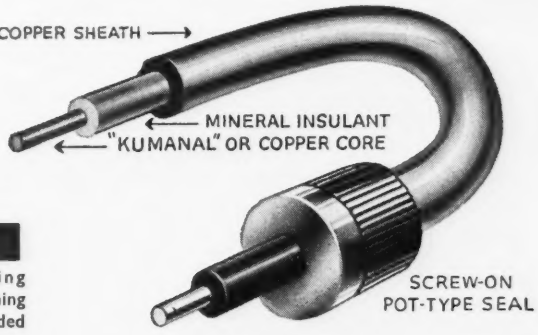
TANKS

Can be used either as immersion heater or externally under suitable thermal insulation. The element is completely insulated within a protective sheath and can be fixed directly to the surface to be heated or immersed in the liquid.



PIPES

Pipe runs of any length are evenly warmed by cable wound spirally around the pipe under the lagging.



THEY ARE SO ADAPTABLE

A new development. Low-temperature heating cables operating at normal mains voltages up to approximately 200°C. Suitable for most purposes in industry where air, fluids or solids have to be maintained at warm temperatures at an economic cost.

Of high thermal efficiency, Pyrotenax Warming Cables give an even heat distribution over any length of run. Fully shrouded, they are perfectly safe even when immersed in liquid.

Enquiries regarding specific applications are invited.

Pyrotenax Warming Cables are :

- **All-mineral**
- **Fire-resistant**
- **Virtually indestructible**
- **Non-ageing**
- **Easily fitted**
- **Absolutely safe**

* *Mineral Insulated*

'PYROTENAX IS AN EXCLUSIVE TRADE MARK NAME AND MUST ONLY BE USED TO DESIGNATE CABLES AND OTHER PRODUCTS MANUFACTURED BY THIS COMPANY AND ITS ASSOCIATES

Pyrotenax
CABLES

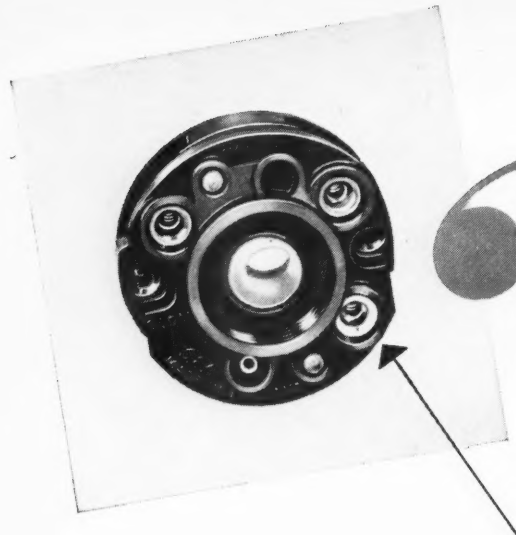
PYROTENAX LIMITED

HEBBURN-ON-TYNE
PHONE : HEBBURN 32244/7

LONDON: Phone : Abbey 1654/5
BIRMINGHAM: Phone : Midland 1265
MANCHESTER: Phone : Blackfriars 6946

LEEDS: Phone : Leeds 27826
GLASGOW: Phone : Central 2238

GD 67



3 Third Terminal ?

"Mutac" silent A.C. single pole switches can be supplied with a third terminal for looping in.

★ For easy identification the third terminal is nickel plated.

★ Available in brown or cream.

★ Prices are highly competitive.

	5-Amp	15-Amp
Surface Patterns	S.3413	S.3613
Flush ,,	S.3423	S.3623
Ceiling ,,	S.3443	—

"MUTAC" (Reg'd Trade Mark) SILENT A.C. SWITCH WITH THIRD TERMINAL

A G.E.C. PRODUCT

THE GENERAL ELECTRIC CO. LTD • MAGNET HOUSE • KINGSWAY • LONDON • W.C 2

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue (*see Notice below for 6th August issue*) and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED advertisements are **PREPAID at 3/- per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number this counts as two words and carries an additional charge of 1/-.**

DISPLAYED:—**£2 per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.**

SITUATIONS WANTED:—**Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.**

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Original testimonials should not be sent with applications for employment

6th AUGUST ISSUE

Classified Advertisements for 6th August have closed for press.

OFFICIAL NOTICES, TENDERS, ETC.

COUNTY BOROUGH OF BLACKPOOL

TENDERS are invited for the supply of the following equipment for the Electrical Services Department:—

127 Medium Class Tubular Steel Poles.
280 Cast Iron Bases (special castings).
280 Tubular Steel Double Arm Brackets.
280 Cast Finials.

The Corporation do not bind themselves to accept the lowest or any tender and reserve the right to accept tenders for the whole or any part of the equipment.

Specifications, drawings, forms of tender and general conditions are obtainable from the Illuminations & Public Street Lighting Officer, Electrical Services Department, Rigby Road East, Blackpool. Separate tenders for each part of the schedule are to be addressed to the undersigned and delivered in a plain sealed envelope to P.O. Box 11, Town Hall, Blackpool, in accordance with the instructions as stated on the forms of tender not later than 10 a.m. Tuesday, 10th August, 1954.

TREVOR T. JONES,
Town Clerk.
4296

STEPNEY M.B.C.

TENDERS are invited for the installation of Electric Lighting and Power Points at the Cephas Street and Doveton Street Housing Scheme, Bancroft Rd., London, E.1, comprising one block 6 Flats and 6 Maisonnettes.

Forms of tender with conditions, etc., obtainable from the Borough Engineer and Surveyor, 227-233, Commercial Road, London, E.1, upon payment of a deposit of £2 2s. Closing date for tenders 23rd August, 1954.

WILFRED REEVE,
Town Clerk. 4356

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the Local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order, 1952.

BRITISH ELECTRICITY AUTHORITY

South Western Division

(a) SECOND ASSISTANT ENGINEER (Civil), Generation Construction Department, Bristol. N.J.B. 2 AX/CX, £834-£1,025.

(b) ASSISTANT SHIFT CHARGE ENGINEER, East Yelland Generating Station. N.J.B. G9, £641-£667.

Superannuation.

Candidates for (a) should preferably be Corporate Members of the Institution of Civil Engineers, be experienced in the design and construction of heavy foundations and building works associated with modern power stations; also in the preparation of preliminary schemes and estimates, specifications, bills of quantities, in writing reports, and general control of building and civil engineering contracts.

For (b) should have a sound technical training and practical operating experience in a modern generating station.

Applications on Form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by (a) 28th August and (b) 7th August, 1954. 4338

JOHNSON & PHILLIPS LIMITED

Staff for South Africa

JOHNSON & PHILLIPS Limited require the following Staff for their South African Branch:—

1. CHIEF DRAUGHTSMAN. Candidates must have good technical and practical qualifications, in addition to experience with leading switchgear manufacturers both in design and contract work.
2. SENIOR SWITCHGEAR DRAUGHTSMAN. Candidates must have good technical and practical training, in addition to experience with leading switchgear manufacturers. Some experience in switchgear design is essential.
3. TECHNICAL SALES ENGINEER. Candidates should have a technical background, preferably not less than Higher National Certificate level, and experience in preparing tenders for switchgear up to 33,000 volts.
4. TECHNICAL SALES PROMOTION ENGINEER. Candidates should have a sound technical background, a pleasing personality, and experience of outside representation among buyers and consultants. Successful candidate will operate from Johannesburg, but may be expected to travel in the Northern part of the Union of South Africa, although most of his contacts will be in and around Johannesburg.

These appointments are for permanent situations at the J. & P. Switchgear Works at Driehoek, Johannesburg, where switchgear up to 11,000 volts is manufactured and enquiries for gear up to 66,000 volts are handled. In all cases preference will be given to men between 28 and 38 years of age. Salaries will be in accordance with qualifications and experience, and good bonus and life assurance schemes are in force. Applicants should clearly state for which post they are applying and state age, experience and salary required.

Applications should be addressed to the Employment & Welfare Manager, Johnson & Phillips Ltd., Charlton, London, S.E.7. 4237

BRITISH ENGINE BOILER AND ELECTRICAL INSURANCE COMPANY LTD., 24, Fennel Street, Manchester, 4

THE company requires additional ELECTRICAL PLANT INSPECTORS in one or two districts. Permanent positions carrying progressive salary scale £540 to £785 and non-contributory pension. Candidates age 26 to 30 years with apprenticeship in the manufacture or repair of electrical machinery and preferably with subsequent experience of industrial use of electrical machinery, and who have gained the Higher National Certificate in Electrical Engineering or are Graduates of the Institution of Electrical Engineers, are invited to apply in own handwriting stating age, qualifications and experience. 4342

MIDDLESEX COUNTY COUNCIL EDUCATION COMMITTEE

LABORATORY STEWARD required at Hendon Technical College for Electrical Engineering Laboratories. Minimum qualifications Ordinary National Certificate and experience in electrical industry. Opportunities within College for further study.

Salary Miscellaneous Grade IV (£470-£550 if 26 or over). Prescribed conditions.

Apply to the Principal, Hendon Technical College, The Burroughs, London, N.W.4, by 20th August (quote X.841ER). Canvassing disqualifies. 4300

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments in the Chilterns Sub-Area:

SUB-AREA HEADQUARTERS,
BEDFORD (100/54.N)

THIRD ASSISTANT ENGINEER (Commercial). Candidates should have had a good general and technical education with experience in industrial and commercial power sales development. A competent knowledge of tariffs, thermal storage space heating and street lighting is essential. Membership of the Institution of Electrical Engineers will be an advantage.

Salary in accordance with Class L, Grade 10 of the National Joint Board Salary Agreement, commencing at £766.

Apply to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend Street, Bedford.

HEMEL HEMPSTEAD DISTRICT
(86/54.R)

THIRD ASSISTANT ENGINEER. Candidates should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. underground and overhead systems.

Salary in accordance with Class E, Grade 9 of the National Joint Board Salary Agreement, commencing at £587.

Apply to the District Manager, Hemel Hempstead, Eastern Electricity Board, 44, Marlowes, Hemel Hempstead, Herts.

Future salaries and conditions of service for both these appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications by letter, stating age, education, qualifications and experience, with details of present appointment and salary, should be submitted to the Manager concerned within 14 days of the appearance of this advertisement. 4335

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT of DISTRICT COMMERCIAL ENGINEER, SOUTH DISTRICT, CHEADLE. Duties will include the organisation and control of all commercial staff and functions of the District; supply of information and advice to all classes of consumers on electricity utilisation, tariffs and all matters concerning electricity services; organisation and supervision of contract wiring work and maintenance services on consumers' premises; control of service centres, demonstrations, exhibitions, etc.; organisation and supervision of consumer records.

Salary scale £1,002/£1,046 p.a., Grade F.2, N.J.B. conditions.

Appointment of GENERAL ASSISTANT ENGINEER (ASSISTANT CHARGE ENGINEER), SUB-AREA MAINS ENGINEER'S DEPARTMENT, MANCHESTER. Applicants should be competent to carry out switching duties on a large E.H.V. and L.V. transmission and distribution system, including the use of supervisory switching, in accordance with instructions received from the Sub-Area Control Charge Engineer. Some experience in switchgear and transformer maintenance will be considered an advantage. The duties will be on a shift basis. Applicants should possess the H.N.C. in Electrical Engineering or an equivalent qualification.

Salary scale £692/£716 p.a., Grade N.13, N.J.B. conditions.

Applications to the Sub-Area Secretary, No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, by 7th August, 1954. 4324

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (a) and Corporate Membership for posts (b) an advantage.

(a) ASSISTANT ENGINEER (Instruments), BANKSIDE GENERATING STATION (Vacancy No. 54/604). Applicants to be capable of maintaining calibrating and testing instruments relating to steam and water flows, pressure and temperature indicators, similar to those used in boiler and turbine plant, and should have received a sound technical training. Salary Class H, Grade 12 = £593 5s. p.a.

(b) DEPUTY STATION SUPERINTENDENT, BLACKWALL POINT GENERATING STATION (Vacancy No. 54/605). Candidates should have received a sound technical training in mechanical and electrical engineering, followed by practical experience in the operation, maintenance and administration of a modern generating station, coupled with a successful record in the promotion of good labour relations. Salary Class F, Grade 3 = £957 12s. p.a.

(b) MAINTENANCE ENGINEER (Mechanical), BRUNSWICK WHARF GENERATING STATION (Vacancy No. 54/606). Wide experience necessary in maintenance of modern generating plant. Duties will include co-ordination of maintenance work and programmes covering the mechanical maintenance of the boiler house, turbine house, coal handling plant, etc. Salary Class K, Grade 7 = £912 9s. p.a. Applications received in reply to previous advertisements will be considered.

(b) SHIFT CHARGE ENGINEER, FULHAM GENERATING STATION (Vacancy No. 54/607). Considerable experience in the operation of a large modern power station necessary. Character and ability to deal with staff problems important. Salary Class L, Grade 7 = £972 6s. per annum.

(a) GENERAL ASSISTANT ENGINEER, TECHNICAL DEPT., DIV. H.Q. (Vacancy No. 54/608). Experience in manufacture and testing of electrical equipment used in generating stations and on high-voltage transmission systems. The successful candidate may be required to work on the power section, metering section or development section, and experience suitable for any of these fields will be considered an advantage, such as commissioning and maintenance of large electrical plant including protective gear, maintenance and calibration of polyphase meters and allied equipment, and calculation of fault currents and load flows in complex A.C. networks. Salary Class AX/EX, Grade 8 = £526 1s. to £670 19s., rising to £749 14s. p.a.

(a) THIRD ASSISTANT ENGINEER, SYSTEM OPERATION DEPARTMENT, THAMES GRID CONTROL AREA (Vacancy No. 54/609). Duties (day or shift) are of a general engineering nature. Applicants should have had a good general and technical education and have passed I.E.E. examination or equivalent. Steam generating station experience an advantage. Salary Class AX, Grade 5 = £681 9s. to £829 10s. to Grade 5, Class EX, £909 6s. to £927 3s. p.a.

(a) JUNIOR ENGINEERS (Vac. No. 54/560). Junior engineers required at various power stations in the London area. Excellent opportunities for training and promotion to higher grades. Salary and conditions of service in accordance with N.J.B. Agreement.

Applications, quoting vacancy number, may be made on form obtainable from the Divisional Secretary, British Electricity Authority, London Division, Generation House, Great Portland Street, London, W.1, and be received within 14 days of this advertisement. 4336

ASSISTANT engineer required with Honours Degree in electrical engineering and preferably having served an apprenticeship with a firm of national repute. Experience in various types of industrial drives and controls and in power generation and distribution an advantage. Age 25/30. Write giving fullest particulars and salary required, to the Personnel Officer, British Cellophane Limited, Bridgwater, Somerset, quoting Ref. No. E8.ER. 4278

POWER STATION ELECTRICAL AND MECHANICAL ENGINEER

required for service with the SUDAN LIGHT & POWER CO. LTD., in KHARTOUM, SUDAN, as DEPUTY POWER STATION SUPERINTENDENT. Basic salary on appointment within the range £E.1,500-£E.2,000 per annum according to qualifications and experience. (£E.1 = £1 0s. 6d.)

Candidates should be between the age of 30 and 45 years, and have had not less than 10 years' experience in the construction and operation of modern power stations equipped with boilers and turbine alternator sets operating at not less than 400 p.s.i.g. and 750° F., and E.H.T. switchgear and associated control equipment. Experience with oil-fired boilers and also diesel alternators up to 1,200 kW of value. Evidence should be produced of having held positions of responsibility requiring organizing and administrative ability. Initially duties will include the supervision of erection and commissioning of a steam power station equipped with two 5-MW steam turbine alternator sets.

Appointment will be on contract by arrangement up to 10 years, including a period of 12 months' probation, with a bonus payable on completion of the contractual period. Free living accommodation with basic furniture or an allowance in lieu thereof will be provided. After satisfactory completion of the probationary period liberal leave on full salary with free passages. In addition to basic salary a cost-of-living allowance will be payable; and a kit allowance of £E.50 on appointment.

Applications, stating age, education, qualifications, experience (with particulars of posts held), present appointment and salary, with names of two references, should be submitted to the Secretary, The Power & Traction Finance Company Limited, Queens House, Kingsway, London, W.C.2. 4140

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following posts:—

JUNIOR ENGINEER, NORWICH GENERATING STATION. Salary Class F/15, £402, Class F/14, £466 per annum.

The duties of the successful applicant will include assisting in the control room on shift and other operation and investigation duties. Preference will be given to applicants who have had previous experience in a generating station and who have reached the standard of the Ordinary National Certificate in Electrical Engineering or its equivalent

SHIFT CHARGE ENGINEER, LETCHWORTH L.2 GENERATING STATION. Salary CLASS D, Grade 7, £633-£643 per annum.

SHIFT CHARGE ENGINEER, COLCHESTER GENERATING STATION. Salary Class B, Grade 7, £559-£586 per annum.

Applicants should preferably have served an apprenticeship and have reached the standard of Ordinary National Certificate in Electrical and/or Mechanical Engineering and possess experience in the operation of generating stations.

Applications stating age, qualifications and experience should be sent to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, by 7th August, 1954.

W. N. C. CLINCH,
Controller.
4347

SENIOR ENGINEER

M.T.E. CONTROL GEAR LIMITED require a Senior Engineer to take charge of the Engineering Department and Drawing Office. Applicants must have had considerable experience in the automatic control gear field (A.C. and D.C.), especially circuit work, component and enclosure design. Administrative experience is also essential.

The person appointed will be entirely responsible for all matters connected with the Drawing Office and Engineering sections, and will work directly under the Technical Director.

Please apply in writing, stating (1) training, (2) experience up to date, (3) commencing salary expected, and (4) age.

M.T.E. CONTROL GEAR LIMITED
Leigh-on-Sea, Essex

4320

CONSULTING ENGINEERS

with extensive practice require the following Drawing Office staff. Salaries in all cases will be above A.E.S.D. rates. Conditions are excellent and pension scheme is in operation. The positions are permanent and promotion prospects are good.

1. SENIOR DRAUGHTSMEN. Sound experience of aircraft structures, for work on the South Coast.
2. DRAUGHTSMEN, sound experience of mechanical design and/or detailing, for interesting work on turbine equipment. Work is in Birmingham.
3. DETAILER DRAUGHTSMEN, sound experience of heavy mechanical equipment, for work in Sheffield.
4. DRAUGHTSMEN, sound experience of plant layout and structural engineering, for work in Weston-super-Mare district.
5. DRAUGHTSMEN, sound experience mechanical engineering, for work in the Weston-super-Mare district.
6. DRAUGHTSMEN with sound experience of electrical equipment design and/or detailing, for work in Bath and Chester.

Subsistence expenses paid to men coming from outside the districts mentioned, except Weston-super-Mare. Please send full particulars of experience, qualifications and age — Box 4264.

DESIGN ENGINEERS

THE ENGLISH ELECTRIC CO. LTD. invite applications for the following positions in their Mechanical Engineering Department at Luton:—

SENIOR DESIGN ENGINEERS. Age 25-35. Minimum qualifications H.N.C. standard with sound engineering training and experience. Applicants must be capable of initiating original designs, and some supervisory experience would be an advantage but not essential.

JUNIOR DESIGN ENGINEERS. Age 21-28. O.N.C. standard, to work in conjunction with Senior Engineers developing designs to a fully completed stage. A sound knowledge of workshop practice is desirable.

All positions require a thorough drawing office background in light/medium mechanical or electro-mechanical engineering. Successful applicants would be engaged on the original design of a wide variety of laboratory equipment, test rigs and specialised machines. Good salaries and conditions for the right men. Apply to Dept. C.P.S., 336/7, Strand, London, W.C.2, quoting ref. 1261A. 4341

SOUTHERN ELECTRICITY BOARD

Demonstrators

BOURNEMOUTH District and Lyndhurst District of No. 4 (Bournemouth) Sub-Area. N.J.C. Grade 1 (£400-£490 per annum). N.J.C. conditions of service.

Applicants should be qualified to advise generally on the utilisation of electric domestic appliances, and to give public demonstrations of apparatus and to assist in showroom duties. The possession of an E.A.W. Certificate or equivalent domestic science qualification would be an advantage.

The successful applicants will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him not later than 13th August, 1954. 4323

BRITISH ELECTRICITY AUTHORITY

North West Merseyside and North Wales Division

VACANCY No. 129/54. SHIFT CHARGE ENGINEER, Stuart Street Generation Station, Manchester. Salary £772/£802 (11 7).

Vacancy No. 132/54. STATION SHIFT CONTROL ENGINEER, Burnley Generating Station. Salary £502/£521 (C.10).

Apply, quoting Vacancy No., to Controller, British Electricity House, 825, Wilmslow Road, Manchester, 20, before 7th August. 4349

BRACKNELL DEVELOPMENT CORPORATION

APPLICATIONS are invited for the appointment of ASSISTANT ENGINEER (ELECTRICAL SERVICES) on the staff of the chief engineer at a salary of £660 × £40 to £860 per annum.

Candidates should be Associate Members of the Institution of Electrical Engineers and should have had good experience in the design and execution of electrical installations. The successful candidate will be required to advise on and prepare schemes for electrical installations in houses, factories, shops, etc., street lighting installations and electrical services, including high tension supplies, in connection with the construction of a new sewage treatment works.

Superannuation schemes. Medical examination. Housing available in due course. Applications giving age, education, experience, qualifications and appointments held (with dates and salaries) together with two referees, should be sent to the General Manager, (AE) Bracknell Development Corporation, Farley Hall, Bracknell, Berks, not later than Saturday, 14th August, 1954. 4357

ARE YOU AN ELECTRICIAN?

IF you are now or have knowledge and previous experience of electrical work you can get

IMMEDIATE EMPLOYMENT

in light engineering work of national importance. These jobs are available in the

SOUTH-WEST LONDON AREA

They provide high earning possibilities for the right men and must be filled quickly. It is essential that applicants give fullest details, including age, nature and extent of experience.

Write to—The Employer, Box 4334.

ADMIRALTY—ROYAL NAVAL SCIENTIFIC SERVICE

SENIOR SCIENTIFIC OFFICERS and SCIENTIFIC OFFICERS required in Experimental Establishments in London, Portsmouth, Weymouth and Gloucestershire areas and Scotland. The majority of posts are for Engineers and Physicists (particularly with Electronics).

Candidates must be British subjects with an appropriate first or second class honours degree or equivalent high professional attainments.

Salaries: S.S.O. (M) £975-£1,150; S.O. (M) £470-£855. London rates. Somewhat lower in Provinces. All appointments are unestablished (with F.S.S.U.), but with some opportunities to compete for established posts.

Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting A.246/52/A. 3723

BRITISH ELECTRICITY AUTHORITY

Midlands Division

JUNIOR ENGINEER is required in the Metering Section of the Technical Department. N.J.B. service conditions, superannuable appointment, salary within Schedule C, Grade 9, commencing in range £390 to £525, ultimately rising to £572 per annum.

Applicants should have had metering experience, particularly in the calibration of electrical indicating instruments, and should preferably possess Ordinary National Certificate.

Apply, quoting Vacancy No. 719MD, on form AE6, available from Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 14th August, 1954. 4333

SOUTH WEST SCOTLAND ELECTRICITY BOARD

Dumfries and Galloway Sub-Area

SENIOR ASSISTANT ENGINEER (CONSTRUCTION) at SUB-AREA HEADQUARTERS.

Applicants should have a wide practical experience in the design, planning, layout and erection of 33-kV, 11-kV and low-voltage overhead and underground mains and substations. Possession of a technical qualification will be an advantage.

The person appointed will be responsible for constructional and civil engineering work in a large area, predominantly rural. The post is superannuable and the salary will be in accordance with the N.J.B. Agreement, Class G, Grade 4, £905/£944 per annum.

Applications, stating age, qualifications and experience, together with the names of two referees, should be forwarded to the undersigned not later than 18th August, 1954.

W. H. WILLS,
Manager.

Marchmount, Dumfries.
21st July, 1954. 4325

ELECTRICAL RESEARCH AND TESTING ENGINEERS

A. REYROLLE & CO. have a number of vacancies for Engineers to be engaged on ELECTRICAL RESEARCH and LABORATORY TESTING in connection with switchgear, protective gear, insulation, etc.

For certain of the vacancies an Honours or Pass Degree is required; for the others a Higher National Certificate is adequate. The work will be varied and interesting and there will be good scope for advancement. Starting salaries in accordance with age, technical qualifications and experience.

Apply with full particulars to the Chief Engineer, A. Reyrolle & Company Ltd., Hebburn, Co. Durham.

4164

BLACKBURN EDUCATION COMMITTEE

Municipal Technical College and School of Art

ENGINEERING DEPARTMENT

APPLICATIONS are invited for the post of Full-Time ASSISTANT LECTURER (Grade A) in the Electrical Engineering Section of the Engineering Department.

Candidates should be capable of teaching Electrical Installation subjects to Course B and C Certificate standard of the City and Guilds, and also Electrical Engineering subjects to at least O.N.C. standard.

A degree in engineering or equivalent qualification is desirable, together with teaching and industrial experience.

Salary in accordance with Burnham Technical Scale for Grade A Assistants, i.e., £415-£18-£670 plus appropriate allowances.

Application forms may be obtained from the Chief Education Officer, Education Offices, Blackburn, and should be returned to him within a fortnight of the appearance of this advertisement. 4322

A FIRM handling medium-powered electrical capital equipment requires the services of an energetic sales manager with wide experience of both home and export trade. Full details to —Box 3914.

ALKALINE BATTERIES Ltd., of Redditch, are the largest makers in the Empire of alkaline accumulators, miners' lamps and emergency lighting systems, which are in rapidly growing use particularly for export. The company has vacancies in its technical sales and development sections for graduate electrical engineers, not over 30 years of age, or for men nearing the end of their degree course who have completed National Service. The posts are pensionable and offer the prospect of executive rank. Applications with full educational details and experience should be addressed —Commercial Manager, Alkaline Batteries Ltd., Union Street, Redditch. 3936

AGENTS required throughout the British Isles for the sale of conduit fittings and allied products. Apply—Box 4340.

AIR MINISTRY Works Department requires in London and Provinces electrical engineering draughtsmen in designs branch. Applicants should have several years' experience in preparation of schemes for illumination and electrical equipment of buildings or in electrical distribution, H.V. and M.V. Appointments carry liability for overseas service, for which allowances payable. Salaries up to £780 p.a., starting pay dependent on age, quals. and experience. Overtime or extra duty allowance payable. Reasonable promotion prospects. Posts temporary and non-pensionable but have long-term possibilities. Competitions held periodically to fill established vacancies. Applications from natural-born British subjects only, quoting A/S, and stating age, quals. and previous appointments, giving dates and stating type of work done, to—Air Ministry, S.2(h)/NA, Cornwall House, Stamford Street, London, S.E.1. 4306

ASSISTANT chief engineer required by company engaged in the design and development of guided weapons. Candidates must be mechanical engineers with first-class qualifications and experience in electronics and light engineering. Knowledge and experience in servo-mechanisms essential since duties would include responsibility for missile control systems, electrical gyros, accelerometers, etc. Applicants should be 30-35 years of age and have sufficient personality and experience to administer and organise the development activity on these subjects. Write in detail, quoting reference G, to—Box AC.91032, Samson Clarks, 57/61, Mortimer Street, London, W.1. 123

ASSISTANT required in the sales office of a cable manufacturing company in the Manchester area, age 25-30 years, preferably with experience in the cable trade but not essential, capable of dealing with correspondence on own initiative. Canteen facilities. Pension fund. State age, experience and salary required to—Box 4196.

ASSISTANT to senior life test engineer required by well-known capacitor manufacturers in S.W. London area. Suitable applicant will be responsible for the day-to-day running of the life test section. Applicants must have a good electrical background, both theoretical and practical, with education to H.N.C. or B.Sc. standard. Apply in writing stating age, experience and salary required to—Box 4077.

ASSISTANT to transformer designer required, preferably with knowledge of protective current transformer design. Please give details of experience, age and salary required to—The Personnel Manager, Ferguson Pailin Ltd., Buckley Street, Higher Openshaw, Manchester, 11. 4313

BOTH meter and relay testers for development work are required by The English Electric Company Ltd. at Stafford. This is not routine work, and technical knowledge is necessary to a minimum of O.N.C. Applicants with suitable experience and qualifications should write, quoting ref. 1175D, to—Dept. C.P.S., 336/7, Strand, London, W.C.2. 4312

BRITISH INSULATED CALLENDER'S CABLES Ltd. invite applications for the following vacancies at their Leigh works, near Manchester: Graduate physicists or electrical engineers for the electro-physical laboratory. The work involves the study of electrical properties of rubber and synthetic insulating materials under a wide range of physical conditions. Investigational work relates to the performance of experimental cables embodying new and improved designs. Candidates should have an interest in the practical use of all types of electrical measuring equipment, but previous industrial experience is not necessary (Ref. A/26/54). Graduate physicists for development laboratory and pilot plant. The positions provide splendid opportunities for recently qualified men who need not have had previous industrial experience. The investigational work involves modifications to existing processes as well as the development of new and improved techniques and designs. A flair for designing and constructing pieces of special equipment with which to conduct experiments would be an advantage but is not essential (Ref. A/3/54). Applications in writing, quoting the appropriate reference, should be addressed to—The Staff Officer, B.I.C.C. Ltd., Prescot, Lancs. 4307

BRITISH OVERSEAS AIRWAYS Corporation require for their new headquarters building at London Airport the following: (1) Electrical works foreman, salary scale £12 6s. to £13 16s. a week; (2) Four assistant electrical works foremen, £11 7s. 6d. to £12 2s. 6d. a week. Foreman must have wide practical experience of operation and maintenance of electrical services, including heavy switchgear, motors, 11-kV distribution, and control of staff. H.N.C. or O.N.C. in electrical engineering, and training in maintenance of cranes, lifts and automatic control mechanisms. Assistant foremen should have wide practical experience of electric lighting and power services in large industrial buildings and control of electricians. O.N.C. in electrical engineering and knowledge of cranes, lifts, etc. Apply Staff Manager, H.O., Airways House, Great West Road, Brentford, Middx., stating age, qualifications and details of past experience and posts held. 4344

BUYER required to take charge of section dealing with supplies of battery-operated traction motors, control gear and ancillary equipment. Must have full technical understanding of equipment and materials used in the electrical industry. Company situated in pleasant country surroundings one hour West of London. Good working conditions. Canteen. Please write, stating age, qualifications, married/single, previous experience, present salary, to—Box 4316.

CEYLON European-controlled company seeks electrical engineer with minimum qualifications Higher National Certificate, preferably unmarried, sound practical knowledge of A.C. and D.C. distribution, alternator and generator installation and maintenance. Estimating and sales experience an advantage. Salary approximately £90 per month, provident fund, medical and other benefits. Write — Box ZC.312, Deacon's Advertising, 36, Leadenhall Street, London, E.C.3. 4318

CONTROL gear agents required with established connections for the sale of a unique and outstanding range. Write, stating experience and area covered, to—Box 4339.

COOKE & FERGUSON Limited, switchgear specialists, require a sales engineer for engineering of schemes and preparation of tenders for indoor and outdoor switchgear. A knowledge of protection is essential, and applicants must be qualified in electrical engineering to at least H.N.C. standard. Salary commensurate with qualifications and experience. Please reply stating age, experience and qualifications to—Personnel Officer, Saxon Works, South Street, Openshaw, Manchester, 11. 4239

DESIGNER required for work on medium and high-voltage power factor correction and furnace capacitors. Must have degree or H.N.C. or the equivalent in electrical engineering, and experience in the design and manufacture of medium/heavy electrical equipment. Good prospects. Write, giving full details of qualifications, age and salary required, to—The Technical Director, A. H. Hunt (Capacitors) Ltd., Bendon Valley, London, S.W.18. 4076

DRAKE & GORHAM (Contractors) Limited, require a senior electrical engineer with first-class qualifications for their London office. Experience of contracting as opposed to manufacturing essential. Write stating education, qualifications, age, experience and salary required to — The Secretary, Drake & Gorham (Contractors) Limited, 36, Grosvenor Gardens, London, S.W.1. 4343

DRAUGHTSMAN for lighting fittings design. Some experience in estimating an advantage. Reply in confidence giving fullest details of training and experience, stating age and salary required, to—R. & A. G. Crossland Ltd., Cartbridge Lane, Walsall. 4210

DRAUGHTSMAN required for low-tension distribution equipment. Apply in writing, stating age, experience and salary required, to —The Personnel Officer, W. T. Henley's Telegraph Works Co. Ltd., Gravesend. 4329

DRAUGHTSMEN. Previous experience in motor control equipment circuit work helpful but not essential if applicants are up to O.N.C. standard. Good salary and prospects. For successful applicants requiring housing accommodation, assistance may be given for skilled and key personnel. Pension scheme; 5-day week; canteen. Details of age, experience, qualifications and commencing salary to —Personnel Officer, Dewhurst & Partner Ltd., Inverness Road, Hounslow, Middlesex. 4200

DRAUGHTSMAN required for design and detail work on electrical/mechanical apparatus. Should be at least of H.N.C. standard. Workshop experience essential. Apply in writing to — Personnel Manager, A. H. Hunt (Capacitors) Ltd., Bendon Valley, Garratt Lane, London, S.W.18. 41

ELECTRICAL contractors, nationally known, require manager for their Glasgow branch, which is rapidly expanding. Applicant should have thorough training in electrical contracting industry and have held positions of responsibility. Estimating experience an advantage. This post offers excellent opportunities of promotion. Apply stating training, experience and age to—Box 4310.

ELECTRICAL draughtsman required by Glasgow firm of engineers for new development project. Five-day week, canteen and superannuation scheme in operation. Written applications desired in the first instance outlining technical education (which should be to at least O.N.C. standard), previous drawing office experience and salary required. Write to —1074, Wm. Porteous & Co., Glasgow. 7528

ELECTRICAL draughtsman required for control gear circuit diagrams. Lift experience preferable but not essential. Write stating age, qualifications and salary expected to— J. & E. Hill Ltd., Lift & Escalator Department, Dartford. 4250

ELECTRICAL draughtsman wanted for design of lighting, power and instrument installations in chemical and metallurgical works. The situation offered calls for a practical outlook and ability to work on own initiative. Higher National Certificate standard essential. Age 22-27. Apply giving full details to—Murex Ltd., Rainham, Essex. 4299

ELECTRICAL engineer wanted (aged 30-40, preferably chartered) to assume leading position, commanding equivalent £1,000 p.a. to start, in design office of London company manufacturing automatic precision machinery. Previous drawing office and industrial experience of control gear and mechanisms essential.—Box 4202.

ELECTRICAL engineer-surveyor required, based on London but for duties as relief surveyor in any part of the country. Suitable for single man only. Minimum qualifications H.N.C. Maximum age 32. Industrial experience a recommendation. Salary scale commencing £540 rising to £785 over ten years. Non-contributory pension scheme and other emoluments. Apply — Manager, Engineering Dept., General Accident Assurance Corpn., 99, Aldwych, London, W.C.2. 4326

ELECTRICIAN for London retail electrical business of good standing. Good position for capable man with high standards of service. State age and details of experience.—Box 7530.

ELECTRONIC engineer required by capacitor manufacturers (East London) for development work on test instruments and electrical research. Opportunity for young engineer with some years' experience.—Box 4225.

ELLIOTT BROS. (LONDON) Ltd. invite applications for appointment as sales and contracts engineer for their electrical instrument measuring division. Electrical engineering background to H.N.C. level and experience of quotation work in the industry desirable. Applications in confidence stating experience, age and salary required to—Personnel Manager, Century Works, Lewisham, London S.E.13. 4143

ENGINEER/draughtsman required by South Lancashire firm manufacturing special purpose machines. Applicants should be at least O.N.C. standard and have some drafting experience of control circuits, etc. Reply stating age, qualifications, experience, salary required, to—Box 4280.

ESTIMATING (sales) clerk (male), age 21/30, required. Good standard in maths. and general education essential. Progressive, superannuation, sports. Permanency for right man. Apply—Personnel Officer, Southern United Telephone Cables Ltd., Dagenham Dock. 4352

HIGHLY skilled electrician required for small contractors. Excellent prospects for advancement. Single men preferred.—Box 4348.

INDUSTRIAL lighting fittings manufacturers (Midland area) require a man with drawing office experience, able to handle enquiries estimating, etc., in preparation for manufacture. Good prospects. Give particulars of experience, age and salary required.—Box 4209.

ILLUMINATING engineer with several years' practical experience required; preference given to applicants with Higher National Certificate in Electrical Engineering. Apply—Chief Illuminating Engineer, Metropolitan-Vickers Electrical Co. Ltd., 1/3, St. Paul's Churchyard, London, E.C.4. 4319

JOINTER/plumber/cable, first-class high tension, required for 12 months' service overseas by large firm electrical engineers. Write fully age, experience.—Box 4227.

JUNIOR draughtsmen required by manufacturers of medium voltage switchgear; 5-day week and superannuation scheme. State service, technical qualifications and salary required to —Ottermill Switchgear Ltd., Ottery St. Mary, Devon. 26

JUNIOR electrician's assistant for south'y established London retail electrical business. Good opportunity for keen young man. State age and full details of career.—Box 7531.

JUNIOR engineer for transformer sales and estimating department. Some experience transformers advisable but not essential. Outer London area.—Box 4214.

JUNIOR technical assistant required for sales section of West London electrical instrument manufacturers. Higher National Certificate standard essential. Write giving details of age, experience, qualifications and salary required.—Box 4354.

LAMP representative required by British Luma Electric Lamp Society to call on co-operative societies and local authorities in Scotland and the Newcastle area. Car provided. Successful applicant will be required to reside in Southern Scotland. Apply before 7th August stating age, experience and basic salary required to—The Commercial Manager, Hardgate Road, Glasgow, S.W.1. 4357

LARGE European-controlled company in Ceylon requires assistant electrical engineer, age 20/30 years, preferably unmarried, sound knowledge of A.C. and D.C. distribution and work covered by general electrical contractors. Attractive terms to right man. Write— Box ZD.313, Deacon's Advertising, 36, Leadenhall Street, London, E.C.3. 4317

MAINTENANCE electrician required for large asphalt plant in S.E. London. Experience in elect. sequence control desirable. E.T.U. rates plus bonus.—Box 7504.

MAINTENANCE electricians required for steel works plant in Cardiff. Knowledge of automatic control gear for A.C. and D.C. motors essential. Must be members of E.T.U. Day work on 44-hour week but prepared to work shifts on 48-hour week.—Box 4243.

MAJOR oil company requires one electrical engineering draughtsman for work in London. Age 25 to 30 years. Candidate should possess the Ordinary National Certificate in Electrical Engineering or have equivalent qualification. Good practical experience required followed by 3 to 5 years in the drawing office on electrical installations for process plants, workshops and factories. He will have opportunities of visiting refineries for periods of temporary duty. Opportunities for promotion to engineering appointments occur within the company and with its associates both in the U.K. and overseas. Write giving full details and quoting H.2067 to — Box 6816, c/o 191, Gresham House, London, E.C.2. 4328

MAJOR oil company requires one electrical engineering draughtsman for work in the Middle East. Age 25-30 years. Candidates should possess the Ordinary National Certificate in Electrical Engineering or have equivalent qualifications. An engineering apprenticeship is required which includes 3 years practical experience in the shops followed by 3-5 years in the drawing office on electrical installations for process plants, workshops and/or factories. Overseas allowance in local currency, free passages out and home, free medical attention, kit allowance, good leave arrangements. Pension scheme. Write stating age and full details of qualifications, quoting F.500, to Box 1169, c/o 191, Gresham House, London, E.C.2. 4355

NON-ring electric lamp manufacturers, London area, require a works manager for their miniature lamp production. Only applicants with full practical experience will be considered. Salary in the region of £2,000 p.a., plus bonus.—Box 4353.

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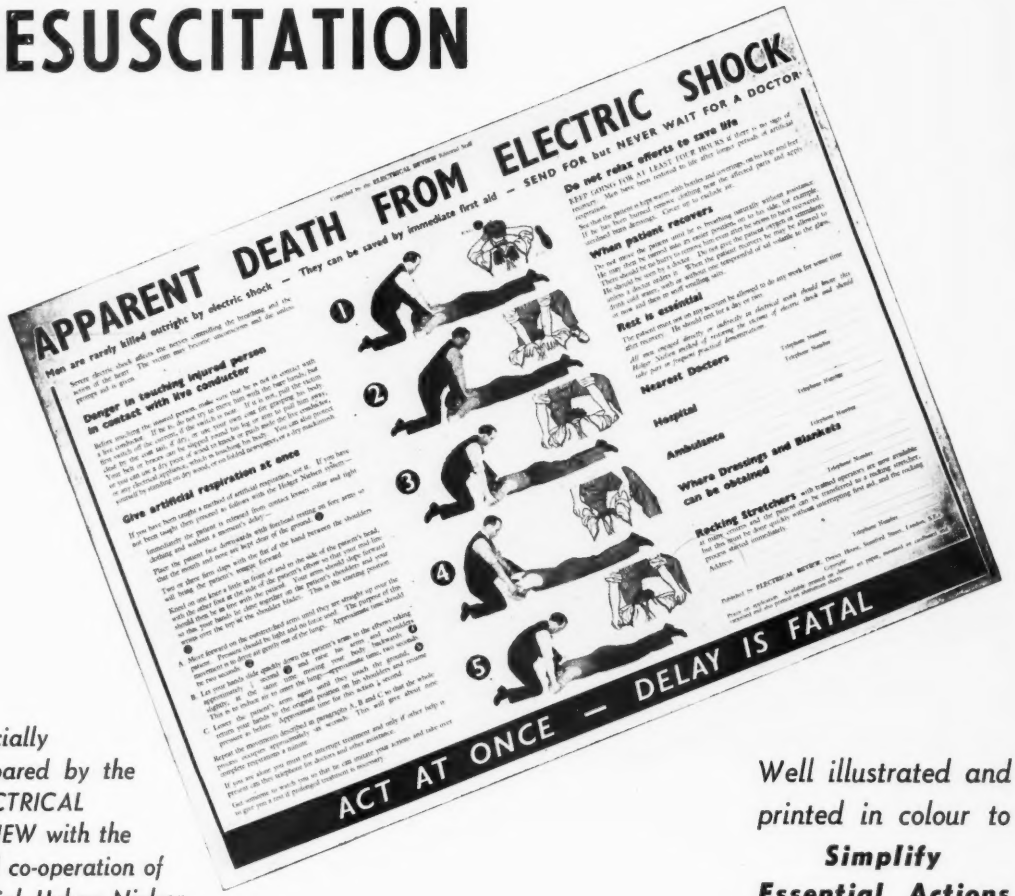
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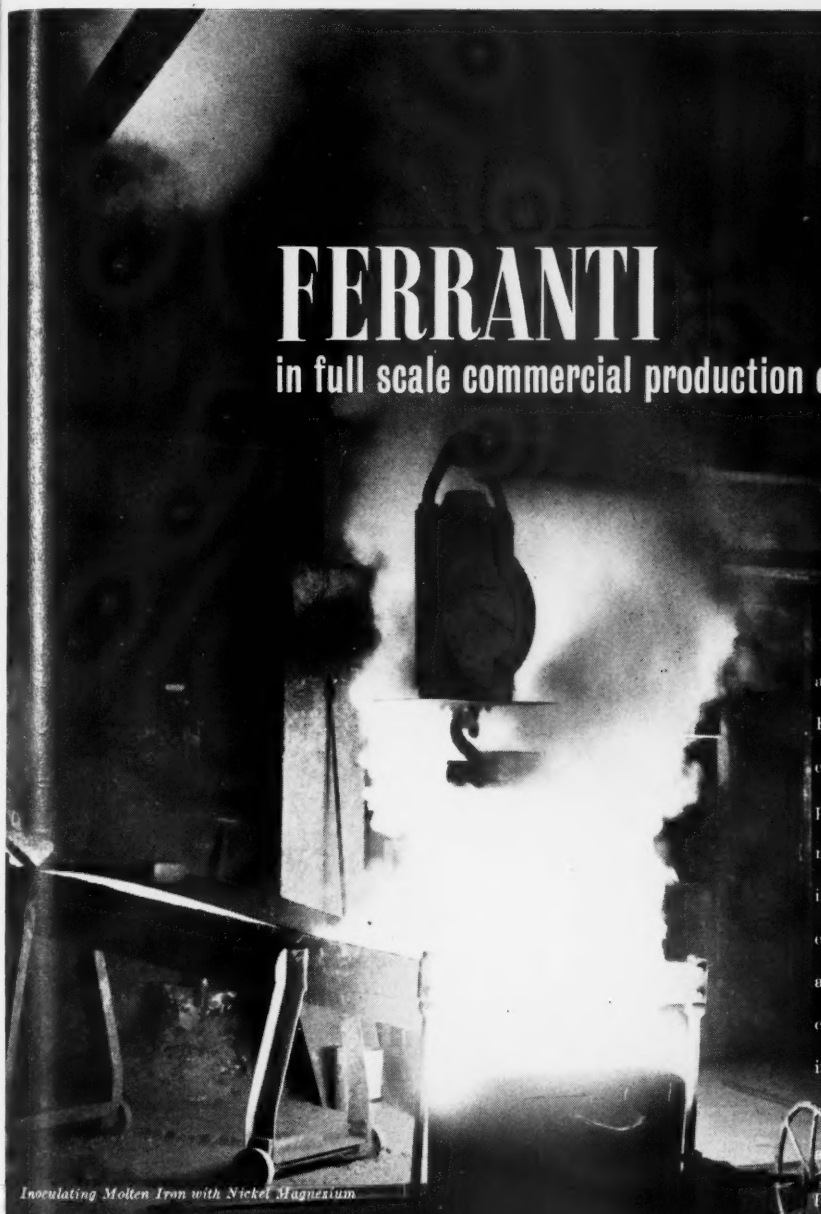

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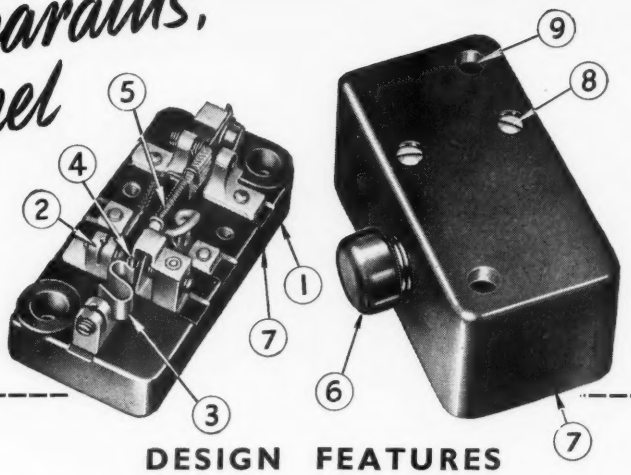

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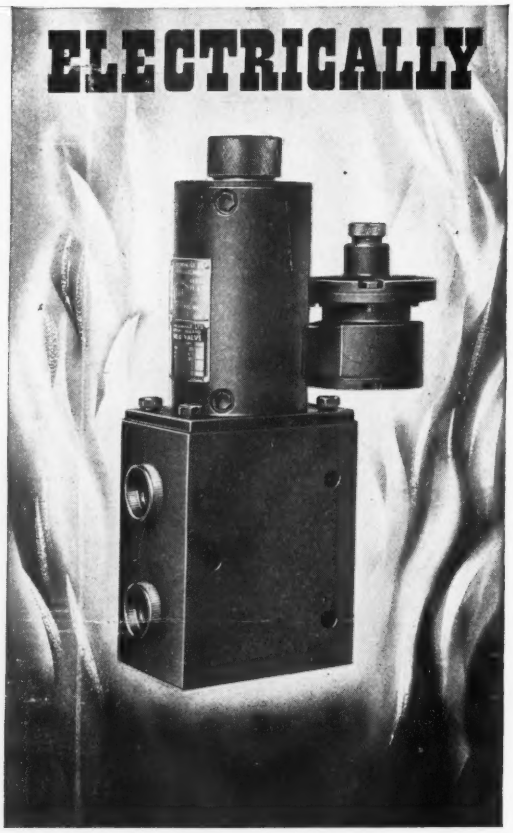

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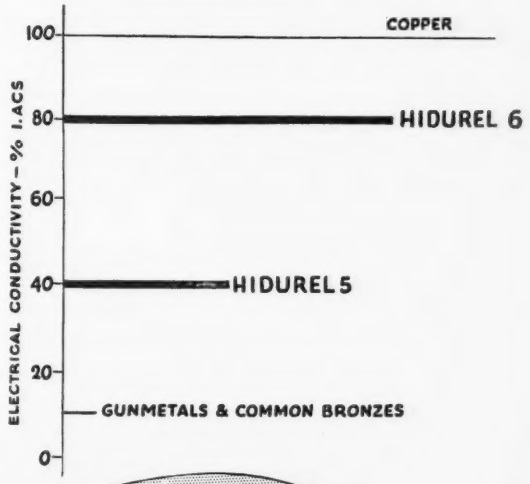

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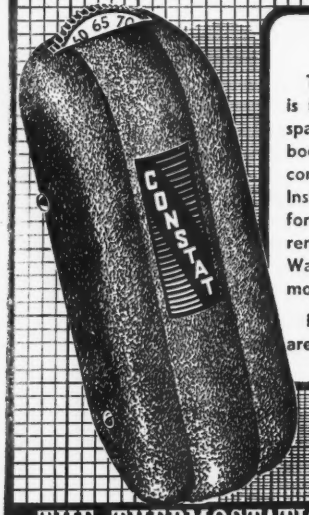

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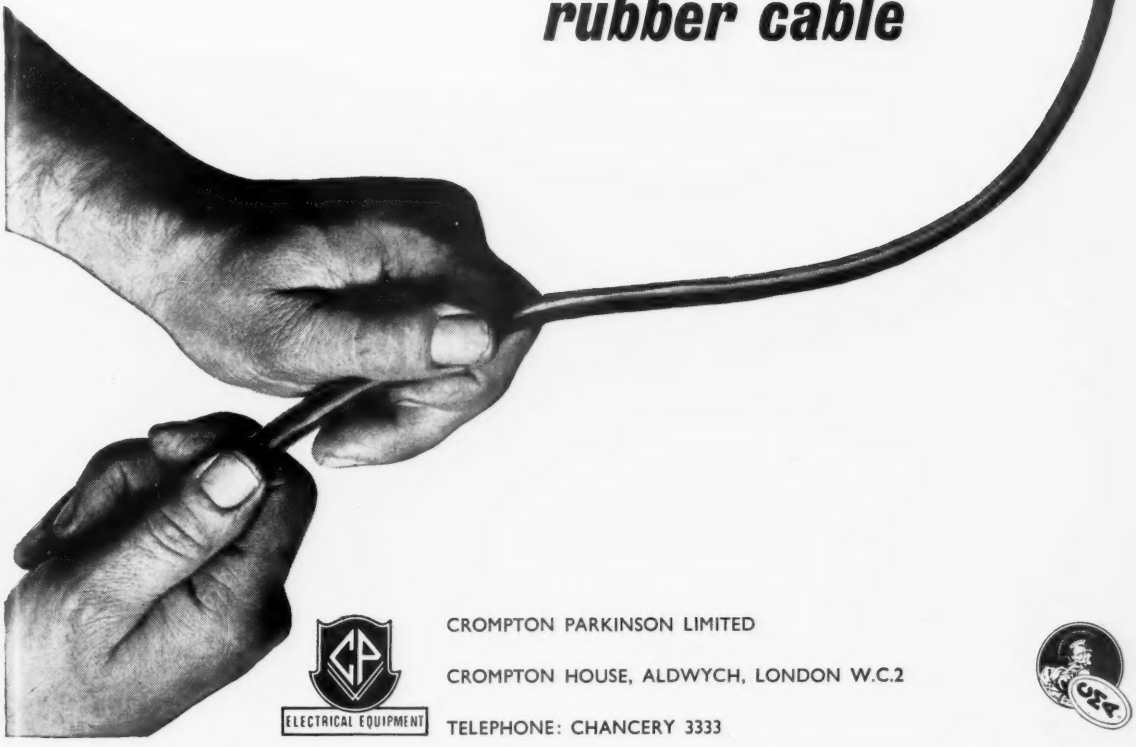

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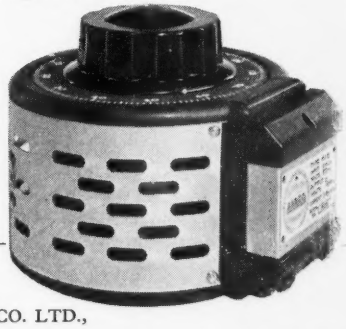

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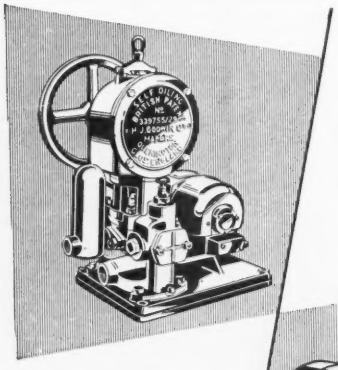

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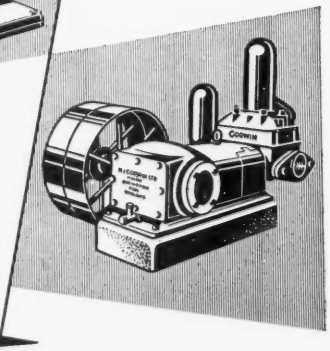

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MANCHESTER 4

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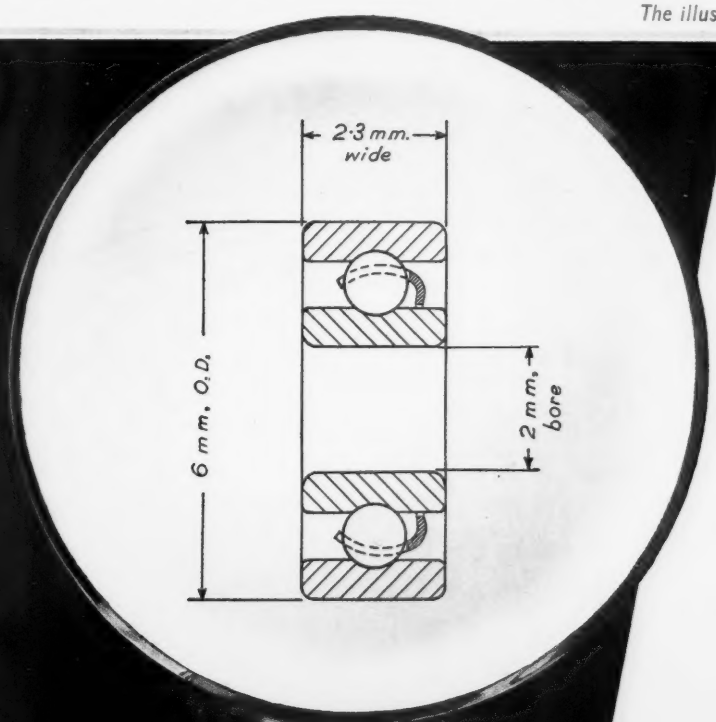
Miniature bearings

TO ANY SIZE AND SPECIFICATION

The illustration shows a typical example



FBC TRADE MARK

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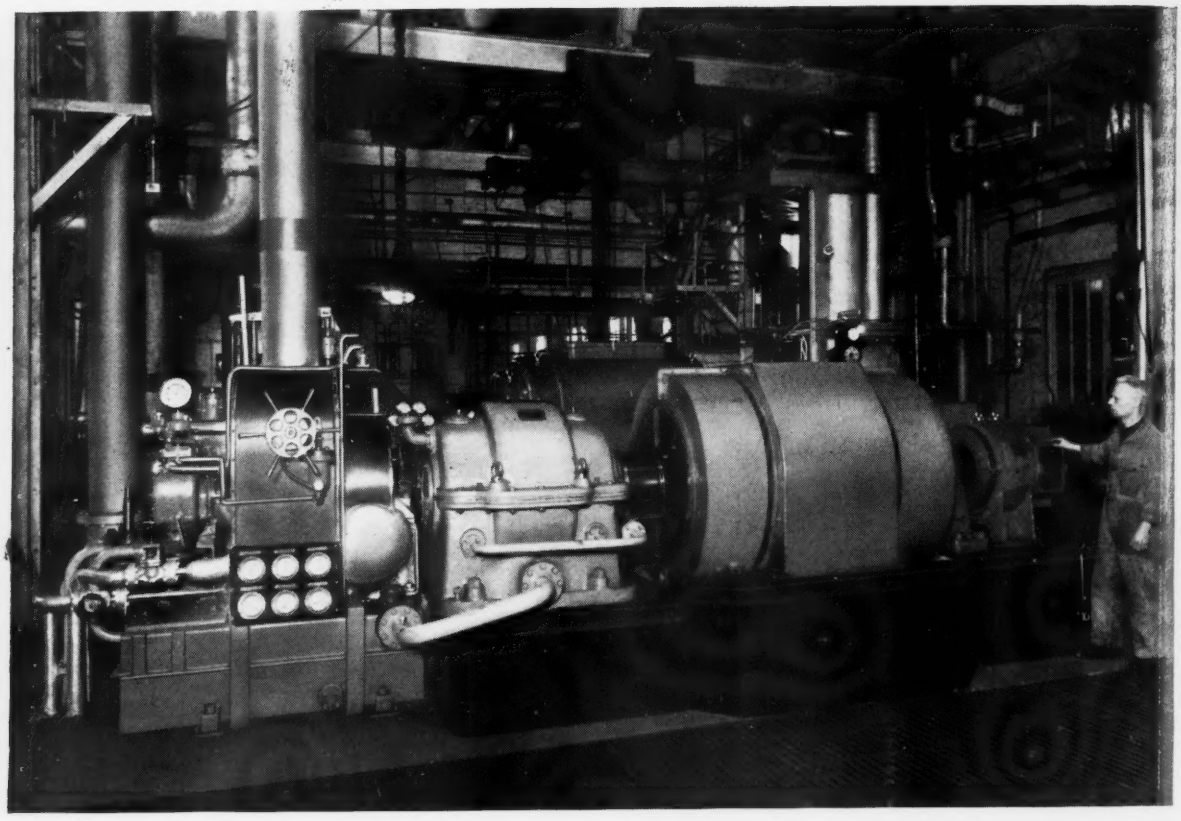
Small Back Pressure Turbines



– and Fuel Economy

The photograph shows one of two 1,250 kW geared back pressure turbo-generators installed in the power house of the Trafford Park works of Metropolitan-Vickers providing steam for factory heating and processes at the minimum fuel cost. Similar machines varying from 100 kW to 2,000 kW are in service in various industries.

Larger direct-coupled back pressure turbo-generators with outputs up to 30,000 kW, and for the highest initial steam conditions in commercial use, have been manufactured for industrial undertakings requiring large quantities of low or medium pressure steam at the highest overall economy.

Write for descriptive leaflet No. 444/2-1

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